The Life Of The Grasshopper

J·H·Fabre

UNIVERSITY OF MAINE
LIBRARIES

From the Library of

MISS GRACE W. TREADWELL

KITTERY, MAINE

There was a piper had a Cow
& he had mangle to give her
He pulled out his pipes & played her a tune
& bade the Cow Consider.

The Cow Considered very well
& gave the piper a penny
And bade him play the other Tune
"Corn rigs are bonny".

THE LIFE OF THE GRASSHOPPER

BOOKS BY J. HENRI FABRE

THE LIFE OF THE SPIDER
THE LIFE OF THE FLY
THE MASON-BEES
BRAMBLE-BEES AND OTHERS
THE HUNTING WASPS
THE LIFE OF THE CATERPILLAR
THE LIFE OF THE GRASSHOPPER
The Life & Love of The Insect.

"A General Sketch of the European War (1st Phase.)
Hilaire Belloc.
(Nelson's Continental Library - 2/)

THE LIFE OF THE GRASSHOPPER

BY

J. HENRI FABRE

TRANSLATED BY

ALEXANDER TEIXEIRA DE MATTOS

FELLOW OF THE ZOOLOGICAL SOCIETY OF LONDON

NEW YORK

DODD, MEAD AND COMPANY

1917

COPYRIGHT, 1917
BY DODD, MEAD AND COMPANY, INC.

CONTENTS

		PAGE
TRANSLATOR'S NOTE	. . . .	vii
CHAPTER		
I	THE FABLE OF THE CICADA AND THE ANT	1
II	THE CICADA: LEAVING THE BURROW	25
III	THE CICADA: THE TRANSFORMATION	42
IV	THE CICADA: HIS MUSIC . .	58
V	THE CICADA: THE LAYING AND THE HATCHING OF THE EGGS	82
VI	THE MANTIS: HER HUNTING .	113
VII	THE MANTIS: HER LOVE-MAKING	137
VIII	THE MANTIS: HER NEST . .	147
IX	THE MANTIS: HER HATCHING .	170
X	THE EMPUSA	191
XI	THE WHITE-FACED DECTICUS: HIS HABITS	211

Contents

CHAPTER		PAGE
XII	THE WHITE-FACED DECTICUS: THE LAYING AND THE HATCHING OF THE EGGS . . .	231
XIII	THE WHITE-FACED DECTICUS: THE INSTRUMENT OF SOUND .	246
XIV	THE GREEN GRASSHOPPER .	275
XV	THE CRICKET: THE BURROW; THE EGG	300
XVI	THE CRICKET: THE SONG; THE PAIRING	327
XVII	THE LOCUSTS: THEIR FUNCTION; THEIR ORGAN OF SOUND	354
XVIII	THE LOCUSTS: THEIR EGGS .	378
XIX	THE LOCUSTS: THE LAST MOULT	401
XX	THE FOAMY CICADELLA . .	424
INDEX	. . . . .	447

TRANSLATOR'S NOTE

I HAVE ventured in the present volume to gather together, under the somewhat loose and inaccurate title of *The Life of the Grasshopper,* the essays scattered over the *Souvenirs entomologiques* that treat of Grasshoppers, Crickets, Locusts and such insects as the Cicada, or *Cigale,* the Mantis and the Cuckoo-spit, or, to adopt the author's happier and more euphonious term, the Foamy Cicadella. They exhaust the number of the orthopterous and homopterous insects discussed by Henri Fabre.

Chapters I. to VIII., XV., XVI. and XIX. have already appeared, in certain cases under different titles and partly in an abbreviated form, in an interesting miscellany extracted from the *Souvenirs,* translated by Mr. Bernard Miall and published by the Century Company. This volume, *Social Life in the Insect World,* is illustrated with admirable photographs of insects, taken from life, and deserves a prominent place on the shelves of every lover of Fabre's works.

Translator's Note

At the moment of writing, the only one of the following essays that has been published before, in my translation, is the first of the three describing the White-faced Decticus, which appeared, in the summer of last year, in the *English Review*.

Miss Frances Rodwell has again lent me the most valuable assistance in preparing this volume; and I am indebted also to Mr. Osman Edwards and Mr. Stephen McKenna for their graceful rhymed versions of the occasional lyrics that adorn it.

ALEXANDER TEIXEIRA DE MATTOS.

CHELSEA, 1917.

CHAPTER I

THE FABLE OF THE CICADA AND THE ANT

FAME is built up mainly of legend; in the animal world, as in the world of men, the story takes precedence of history. Insects in particular, whether they attract our attention in this way or in that, have their fair share in a folk-lore which pays but little regard to truth.

For instance, who does not know the Cicada, at least by name? Where, in the entomological world, can we find a renown that equals hers? Her reputation as an inveterate singer, who takes no thought for the future, has formed a subject for our earliest exercises in repetition. In verses that are very easily learnt, she is shown to us, when the bitter winds begin to blow, quite destitute and hurrying to her neighbour, the Ant, to announce her hunger. The would-be borrower meets with a poor

welcome and with a reply which has remained proverbial and is the chief cause of the little creature's fame. Those two short lines,

Vous chantiez! J'en suis bien en aise.
Eh bien, dansez maintenant,[1]

with their petty malice, have done more for the Cicada's celebrity than all her talent as a musician. They enter the child's mind like a wedge and never leave it.

To most of us, the Cicada's song is unknown, for she dwells in the land of the olive-trees; but we all, big and little, have heard of the snub which she received from the Ant. See how reputations are made! A story of very doubtful value, offending as much against morality as against natural history; a nursery-tale whose only merit lies in its brevity: there we have the origin of a renown which will tower over the ruins of the centuries like Hop-o'-my-Thumb's boots and Little Red-Riding-Hood's basket.

[1] You used to sing! I'm glad to know it.
Well, try dancing for a change!

The Fable of the Cicada and the Ant

The child is essentially conservative. Custom and traditions become indestructible once they are confided to the archives of his memory. We owe to him the celebrity of the Cicada, whose woes he stammered in his first attempts at recitation. He preserves for us the glaring absurdities that are part and parcel of the fable: the Cicada will always be hungry when the cold comes, though there are no Cicadæ left in the winter; she will always beg for the alms of a few grains of wheat, a food quite out of keeping with her delicate sucker; the supplicant is supposed to hunt for Flies and grubs, she who never eats!

Whom are we to hold responsible for these curious blunders? La Fontaine,[1] who charms us in most of his fables with his exquisite delicacy of observation, is very ill-inspired in this case. He knows thoroughly his common subjects, the Fox, the Wolf, the Cat, the Goat, the Crow, the Rat, the Weasel and many others, whose sayings and doings he describes to us with delightful precision of detail. They are local characters, neighbours, housemates of his. Their

[1] Jean de La Fontaine (1621-1695), the author of the world-famous *Fables.—Translator's Note.*

public and private life is spent under his eyes; but, where Jack Rabbit gambols, the Cicada is an entire stranger: La Fontaine never heard of her, never saw her. To him the famous singer is undoubtedly a Grasshopper.

Grandville,[1] whose drawings have the same delicious spice of malice as the text itself, falls into the same error. In his illustration, we see the Ant arrayed like an industrious housewife. Standing on her threshold, beside great sacks of wheat, she turns a contemptuous back on the borrower, who is holding out her foot, I beg pardon, her hand. The second figure wears a great cartwheel hat, with a guitar under her arm and her skirt plastered to her legs by the wind, and is the perfect picture of a Grasshopper. Grandville no more than La Fontaine suspected the real appearance of the Cicada; he reproduced magnificently the general mistake.

For the rest, La Fontaine, in his poor

[1] Jean Ignace Isidore Gérard (1803-1847), better known by his pseudonym of Grandville, a famous French caricaturist and illustrator of La Fontaine's *Fables*, Béranger's *Chansons* and the standard French editions of *Robinson Crusoe* and *Gulliver's Travels*.—*Translator's Note.*

little story, only echoes another fabulist. The legend of the Cicada's sorry welcome by the Ant is as old as selfishness, that is to say, as old as the world. The children of Athens, going to school with their esparto-grass baskets crammed with figs and olives, were already mumbling it as a piece for recitation:

"In winter," said they, "the Ants dry their wet provisions in the sun. Up comes a hungry Cicada begging. She asks for a few grains. The greedy hoarders reply, 'You used to sing in summer; now dance in winter.'" [1]

This, although a little more baldly put, is precisely La Fontaine's theme and is contrary to all sound knowledge.

[1] Sir Roger L'Estrange attributes the fable to Anianus and, as is usual in the English version, substitutes the Grasshopper for the Cicada. It may be interesting to quote his translation:

"As the Ants were airing their provisions one winter, up comes a hungry Grasshopper to 'em and begs a charity. They told him that he should have wrought in summer, if he would not have wanted in winter. 'Well,' says the Grasshopper, 'but I was not idle neither; for I sung out the whole season.' 'Nay then,' said they, 'you shall e'en do well to make a merry year on't and dance in winter to the tune that you sung in summer.'"—*Translator's Note.*

Nevertheless the fable comes to us from Greece, which is preeminently the land of olive-trees and Cicadæ. Was Æsop really the author, as tradition pretends? It is doubtful. Nor does it matter, after all: the narrator is a Greek and a fellow-countryman of the Cicada, whom he must know well enough. My village does not contain a peasant so ignorant as to be unaware of the absolute lack of Cicadæ in winter; every tiller of the soil is familiar with the insect's primary state, the larva, which he turns over with his spade as often as he has occasion to bank up the olive-trees at the approach of the cold weather; he knows, from seeing it a thousand times along the paths, how this grub leaves the ground through a round pit of its own making, how it fastens on to some twig, splits its back, divests itself of its skin, now drier than shrivelled parchment, and turns into the Cicada, pale grass-green at first, soon to be succeeded by brown.

The Attic peasant was no fool either: he had remarked that which cannot escape the least observant eye; he also knew what my rustic neighbours know so well. The poet, whoever he may have been, who invented the fable was writing under the best con-

ditions for knowing all about these things. Then whence did the blunders in his story arise?

The Greek fabulist had less excuse than La Fontaine for portraying the Cicada of the books instead of going to the actual Cicada, whose cymbals were echoing at his side; heedless of the real, he followed tradition. He himself was but echoing a more ancient scribe; he was repeating some legend handed down from India, the venerable mother of civilizations. Without knowing exactly the story which the Hindu's reed had put in writing to show the danger of a life led without foresight, we are entitled to believe that the little dialogue set down was nearer to the truth than the conversation between the Cicada and the Ant. India, the great lover of animals, was incapable of committing such a mistake. Everything seems to tell us that the leading figure in the original fable was not our Cicada but rather some other creature, an insect if you will, whose habits corresponded fittingly with the text adopted.

Imported into Greece, after serving for centuries to make the wise reflect and to amuse the children on the banks of the

Indus, the ancient story, perhaps as old as the first piece of economical advice vouchsafed by Paterfamilias and handed down more or less faithfully from memory to memory, must have undergone an alteration in its details, as do all legends which the course of the ages adapts to circumstances of time and place.

The Greek, not possessing in his fields the insect of which the Hindu spoke, dragged in, as the nearest thing to it, the Cicada, even as in Paris, the modern Athens, the Cicada is replaced by the Grasshopper. The mischief was done. Henceforth ineradicable, since it has been confided to the memory of childhood, the mistake will prevail against an obvious truth.

Let us try to rehabilitate the singer slandered by the fable. He is, I hasten to admit, an importunate neighbour. Every summer he comes and settles in his hundreds outside my door, attracted by the greenery of two tall plane-trees; and here, from sunrise to sunset, the rasping of his harsh symphony goes through my head. Amid this deafening concert, thought is impossible; one's ideas reel and whirl, are incapable of concentrating. When I have not profited by

the early hours of the morning, my day is lost.

Oh, little demon, plague of my dwelling which I should like to have so peaceful, they say that the Athenians used to rear you in a cage to enjoy your singing at their ease! One we could do with, perhaps, during the drowsy hour of digestion; but hundreds at a time, all rattling and drumming in our ears when we are trying to collect our thoughts, that is sheer torture! You say that you were here first, do you? Before I came, you were in undisputed possession of the two plane-trees; and it is I who am the intruder there. I agree. Nevertheless, muffle your drums, moderate your arpeggios, for the sake of your biographer!

Truth will have none of the absurd rigmarole which we find in the fable. That there are sometimes relations between the Cicada and the Ant is most certain; only, these relations are the converse of what we are told. They are not made on the initiative of the Cicada, who is never dependent on the aid of others for his living; they come from the Ant, a greedy spoiler, who monopolizes every edible thing for her granaries. At no time does the Cicada go

crying famine at the doors of the Ant-hills, promising honestly to repay principal and interest; on the contrary, it is the Ant who, driven by hunger, begs and entreats the singer. Entreats, do I say? Borrowing and repaying form no part of the pillager's habits. She despoils the Cicada, brazenly robs him of his possessions. Let us describe this theft, a curious point in natural history and, as yet, unknown.

In July, during the stifling heat of the afternoon, when the insect populace, parched with thirst, vainly wanders around the limp and withered flowers in search of refreshment, the Cicada laughs at the general need. With that delicate gimlet, his rostrum, he broaches a cask in his inexhaustible cellar. Sitting, always singing, on the branch of a shrub, he bores through the firm, smooth bark swollen with sap ripened by the sun. Driving his sucker through the bung-hole, he drinks luxuriously, motionless and rapt in contemplation, absorbed in the charms of syrup and song.

Watch him for a little while. We shall perhaps witness unexpected tribulation. There are many thirsty ones prowling around, in fact; they discover the well be-

trayed by the sap that oozes from the margin. They hasten up, at first with some discretion, confining themselves to licking the fluid as it exudes. I see gathering around the mellifluous puncture Wasps, Flies, Earwigs, Sphex-wasps,[1] Pompili,[2] Rose-chafers [3] and, above all, Ants.

The smallest, in order to reach the well, slip under the abdomen of the Cicada, who good-naturedly raises himself on his legs and leaves a free passage for the intruders; the larger ones, unable to stand still for impatience, quickly snatch a sip, retreat, take a walk on the neighbouring branches and then return and show greater enterprise. The coveting becomes more eager; the discreet ones of a moment ago develop into turbulent aggressors, ready to chase away from the spring the well-sinker who caused it to gush forth.

In this brigandage, the worst offenders

[1] Cf. *The Hunting Wasps,* by J. Henri Fabre, translated by Alexander Teixeira de Mattos: chaps. iv. to x. —*Translator's Note.*

[2] For the Pompilus-wasp, or Ringed Calicurgus, cf. *The Life and Love of the Insect,* by J. Henri Fabre, translated by Alexander Teixeira de Mattos: chap. xii. —*Translator's Note.*

[3] For the grub of the Rose-chafer, or Cetonia, cf. *The Life and Love of the Insect:* chap. xi.—*Translator's Note.*

are the Ants. I have seen them nibbling at the ends of the Cicada's legs; I have caught them tugging at the tips of his wings, climbing on his back, tickling his antennæ. One, greatly daring, went to the length, before my eyes, of catching hold of his sucker and trying to pull it out.

Thus worried by these pigmies and losing all patience, the giant ends by abandoning the well. He flees, spraying the robbers with his urine as he goes. What cares the Ant for this expression of supreme contempt! Her object is attained. She is now the mistress of the spring, which dries up only too soon when the pump that made it flow ceases to work. There is little of it, but that little is exquisite. It is so much to the good, enabling her to wait for another draught, acquired in the same fashion, as soon as the occasion presents itself.

You see, the actual facts entirely reverse the parts assigned in the fable. The hardened beggar, who does not shrink from theft, is the Ant; the industrious artisan, gladly sharing his possessions with the sufferer, is the Cicada. I will mention one more detail; and the reversal of characters will stand out even more clearly. After five

or six weeks of wassail, which is a long space of time, the singer, exhausted by the strain of life, drops from the tree. The sun dries up the body; the feet of the passers-by crush it. The Ant, always a highway-robber in search of spoil, comes upon it. She cuts up the rich dish, dissects it, carves it and reduces it to morsels which go to swell her hoard of provisions. It is not unusual to see a dying Cicada, with his wing still quivering in the dust, drawn and quartered by a gang of knackers. He is quite black with them. After this cannibalistic proceeding, there is no question as to the true relations between the two insects.

The ancients held the Cicada in high favour. Anacreon, the Greek Béranger,[1] devoted an ode to singing his praises in curiously exaggerated language:

"Thou art almost like unto the gods," says he.

The reasons which he gives for this apotheosis are none of the best. They consist of these three privileges: *γηγενής, απαθής, ἀναιμόσαρκε;* earthborn, insensible to pain, bloodless. Let us not start reproaching

[1] Pierre Jean de Béranger (1780-1857), the popular French lyric poet.—*Translator's Note.*

the poet for these blunders, which were generally believed at the time and perpetuated for very long after, until the observer's searching eyes were opened. Besides, it does not do to look so closely at verses whose chief merit lies in harmony and rhythm.

Even in our own days, the Provençal poets, who are at least as familiar with the Cicada as Anacreon was, are not so very careful of the truth in celebrating the insect which they take as an emblem. One of my friends, a fervent observer and a scrupulous realist, escapes this reproach. He has authorized me to take from his unpublished verse the following Provençal ballad, which depicts the relations between the Cicada and the Ant with strictly scientific accuracy. I leave to him the responsibility for his poetic images and his moral views, delicate flowers outside my province as a naturalist; but I can vouch for the truth of his story, which tallies with what I see every summer on the lilac-trees in my garden.

La Cigalo e la Fournigo

I

Jour de Dièu, queto caud! Bèu tèms pèr la cigalo
Que, trefoulido, se regalo
D'uno raisso de fiò; bèu tèms pèr la meissoun.
Dins lis erso d'or, lou segaire,
Ren plega, pitre au vent, rustico e canto gaire:
Dins soun gousiè, la set estranglo la cansoun.

Tèms benesi pèr tu. Dounc, ardit! cigaleto,
Fai-lei brusi, ti chimbaleto,
E brandusso lou ventre à creba ti mirau.
L'Ome enterin mando la daio,
Que vai balin-balan de longo e que dardaio
L'uiau de soun acié sus li rous espigau.

Plèn d'aigo pèr la péiro e tampouna d'erbiho
Lou coufié sus l'anco pendiho.
Se la péiro es au frès dins soun estui de bos
E se de longo es abèurado,
L'Ome barbelo au fiò d'aqueli souleiado
Que fan bouli de fes la mesoulo dis os.

Tu, Cigalo, as un biais pèr la set: dins la rusco
Tendro e jutouso d'uno busco,
L'aguio de toun bè cabusso e cavo un pous.
Lou sirò monto pèr la draio.
T'amourres à la fon melicouso que raio,
E dòu sourgènt sucra bèves lou teta-dous.

Mai pas toujour en pas, oh! que nàni: de laire,
Vesin, vesino o barrulaire,
T'an vist cava lou pous. An set; vènon, doulènt,
Te prène un degout pèr si tasso.
Mesfiso-te, ma bello: aqueli curo-biasso,
Umble d'abord, soun lèu de gusas insoulènt.

Quiston un chicouloun de rèn; pièi de ti resto
Soun plus countènt, ausson la testo
E volon tout. L'auran. Sis arpioun en rastèu
Te gatihoun lou bout de l'alo.
Sus ta larjo esquinasso es un mounto-davalo;
T'aganton pèr lou bè, li bano, lis artèu;

Tiron d'eici, d'eilà. L'impaciènci te gagno.
Pst! pst! d'un giscle de pissagno
Aspèrges l'assemblado e quites lou ramèu.
T'en vas bèn liuen de la racaio,

The Fable of the Cicada and the Ant

Que t'a rauba lou pous, e ris, e se gougaio,
E se lipo li brego enviscado de mèu.

Or d'aqueli boumian abèura sens fatigo,
Lou mai tihous es la fournigo.
Mousco, cabrian, guespo e tavan embana,
Espeloufi de touto meno,
Costo-en-long qu'à toun pous lou souleias ameno,
N'an pas soun testardige à te faire enana.

Pèr t'esquicha l'artèu, te coutiga lou mourre,
Te pessuga lou nas, pèr courre
A l'oumbro de toun ventre, osco! degun la vau.
Lou marrit-péu prend pèr escalo
Uno patto e te monto, ardido, sus lis alo,
E s'espasso, insoulènto, e vai d'amont, d'avau.

II

Aro veici qu'es pas de crèire.
Ancian tèms, nous dison li rèire,
Un jour d'ivèr, la fam te prenguè. Lou front bas
E d'escoundoun anères vèire,
Dins si grand magasin, la fournigo, eilàbas.

L'endrudido au soulèu secavo,
Avans de lis escoundre en cavo,
Si blad qu'aviè mousi l'eigagno de la niue.
Quand èron lest lis ensacavo.
Tu survènes alor, emé de plour is iue.

Ié disés: "Fai bèn fre; l'aurasso
"D'un caire à l'autre me tirasso
"Avanido de fam. A toun riche mouloun
"Leisso-me prène pèr ma biasso.
"Te lou rendrai segur au bèu tèms di meloun.

"Presto-me un pau de gran." Mai, bouto,
Se cresès que l'autro t'escouto,
T'enganes. Di gros sa, rèn de rèn sara tièu.
"Vai-t'en plus liuen rascia de bouto;
"Crebo de fam l'ivèr, tu que cantes l'estièu."

Ansin charro la fablo antico
Pèr nous counséia la pratico
Di sarro-piastro, urous de nousa li courdoun
De si bourso.—Que la coulico
Rousiguè la tripaio en aqueli coudoun!

Me fai susa, lou fabulisto,
Quand dis que l'ivèr vas en quisto

The Fable of the Cicada and the Ant

De mousco, verme, gran, tu que manges jamai.
De blad! Que n'en fariès, ma fisto!
As ta fon melicouso e demandes rèn mai.

Que t'enchau l'ivèr! Ta famiho
A la sousto en terro soumiho,
E tu dormes la som que n'a ges de revèi;
Toun cadabre toumbo en douliho.
Un jour, en tafurant, la fournigo lou vèi.

De ta magro péu dessecado
La marriasso fai becado;
Te curo lou perus, te chapouto à moucèu,
T'encafourno pèr car-salado,
Requisto prouvisioun, l'ivèr, en tèms de nèu.

III

Vaqui l'istori veritablo
Bèn liuen dòu conte de la fablo.
Que n'en pensas, canèu de sort!
—O ramaissaire de dardeno,
Det croucu, boumbudo bedeno
Que gouvernas lou mounde emé lou coffre-fort,

Fasès courre lou bru, canaio,
Que l'artisto jamai travaio

E dèu pati, lou bedigas.
Teisas-vous dounc: quand di lambrusco
La Cigalo a cava la rusco,
Raubas soun bèure, e pièi, morto, la rousigas.

Thus speaks my friend, in his expressive Provençal tongue, rehabilitating the Cicada, who has been so grossly libelled by the fabulist.

TRANSLATOR'S NOTE

I am indebted for the following translation to the felicitous pen of my friend Mr. Osman Edwards:

THE CICADA AND THE ANT

I

Ye gods, what heat! Cicada thrills
With mad delight when fairy rills
Submerge the corn in waves of gold,
When, with bowed back and toil untold,
His blade the songless reaper plies,
For in dry throats song gasps and dies.

This hour is thine: then, loud and clear,
Thy cymbals clash, Cicada dear,

The Fable of the Cicada and the Ant

Let mirrors crack, let belly writhe!
Behold! The man yet darts his scythe,
Whose glitter lifts and drops again
A lightning-flash on ruddy grain.

With grass and water well supplied,
His whetstone dangles at his side;
The whetstone in its case of wood
Has moisture for each thirsty mood;
But he, poor fellow, pants and moans,
The marrow boiling in his bones.

Dost thirst, Cicada? Never mind!
Deep in a young bough's tender rind
Thy sharp proboscis bores a well,
Whence, narrowly, sweet juices swell.
Ah, soon what honied joys are thine
To quaff a vintage so divine!

In peace? Not always. . . . There's a band
Of roving thieves (or close at hand)
Who watched thee draw the nectar up
And beg one drop with doleful cup.
Beware, my love! They humbly crave;
Soon each will prove a saucy knave.

The merest sip?—'Tis set aside.
What's left?—They are not satisfied.
All must be theirs, who rudely fling
A rakish claw athwart thy wing;
Next on thy back swarm up and down,
From tip to toe, from tail to crown.

The Life of the Grasshopper

On every side they fuss and fret,
Provoking an impatient jet;
Thou leavest soon the sprinkled rind,
Its robber-rascals, far behind;
Thy well purloined, each grins and skips
And licks the honey from her lips.

No tireless, quenchless mendicant
Is so persistent as the Ant;
Wasps, Beetles, Hornets, Drones and Flies,
Sharpers of every sort and size,
Loafers, intent on ousting thee,
All are less obstinate than she.

To pinch thy toe, thy nose to tweak,
To tickle face and loins, to sneak
Beneath thy belly, who so bold?
Give her the tiniest foothold,
The slut will march from side to side
Across thy wings in shameless pride.

II

Now here's a story that is told,
Incredible, by men of old:
Once starving on a winter's day
By secret, miserable way
Thou soughtest out the Ant and found
Her spacious warehouse underground.

That rich possessor in the sun
Was busy drying, one by one,
Her treasures, moist with the night's dew,
Before she buried them from view

In corn-sacks of sufficient size;
Then didst thou sue with tearful eyes,

Saying, " Alas! This deadly breeze
" Pursues me everywhere; I freeze
" With hunger; let me fill (no more!)
" My wallet from that copious store;
" Next year, when melons are full-blown,
" Be sure I shall repay the loan!

" Lend me a little corn! "—Absurd!
Of course she will not hear a word;
Thou wilt not win, for all thy pain,
From bulging sacks a single grain.
" Be off and scrape the binns! " she cries:
" Who sang in June, in winter dies."

Thus doth the ancient tail impart
Fit moral for a miser's heart;
Bids him all charity forget
And draw his purse-strings tighter yet.
May colic chase such scurvy knaves
With pangs internal to their graves!

A sorry fabulist, indeed,
Who fancied that the winter's need
Would drive thee to subsist, forlorn,
On Flies, on grubs, on grains of corn;
No need was ever thine of those,
For whom the honied fountain flows.

What matters winter? All thy kin
Beneath the earth are gathered in;

Thou sleepest with unwaking heart,
While the frail body falls apart
In rags that unregarded lie,
Save by the Ant's rapacious eye.

She, groping greedily, one day
Makes of thy shrivelled corpse her prey;
Dissects the trunk, gnaws limb from limb,
Concocts, according to her whim,
A salad such grim housewives know,
A tit-bit saved for hours of snow.

III

That, gentlemen, is truly told,
Unlike the fairy-tale of old;
But finds it favour in his sight,
Who grabs at farthings, day and night?
Pot-bellied, crooked-fingered, he
Would rule the world with L.S.D.

Such riff-raff spread the vulgar view
That "artists are a lazy crew,"
That "fools must suffer." Silent be!
When the Cicada taps the tree,
You steal his drink; when life has fled,
You basely batten on the dead.

CHAPTER II

THE CICADA: LEAVING THE BURROW

TO come back to the Cicada after Réaumur[1] has told the insect's story would be waste of time, save that the disciple enjoys an advantage unknown to the master. The great naturalist received the materials for his work from my part of the world; his subjects came by barge after being carefully preserved in spirits. I, on the other hand, live in the Cicada's company. When July comes, he takes possession of the enclosure right up to the threshold of the house. The hermitage is our joint property. I remain master indoors; but out of doors he is the sovereign lord and an extremely noisy and abusive one. Our near neighbourhood and constant association

[1] René Antoine Ferchault de Réaumur (1683-1757), inventor of the Réaumur thermometer and author of *Mémoires pour servir à l'histoire naturelle des insectes.* —*Translator's Note.*

have enabled me to enter into certain details of which Réaumur could not dream.

The first Cicadæ appear at the time of the summer solstice. Along the much-trodden paths baked by the sun and hardened by the frequent passage of feet there open, level with the ground, round orifices about the size of a man's thumb. These are the exit-holes of the Cicada-larvæ, who come up from the depths to undergo their transformation on the surface. They are more or less everywhere, except in soil turned over by the plough. Their usual position is in the driest spots, those most exposed to the sun, especially by the side of the roads. Equipped with powerful tools to pass, if necessary, through sandstone and dried clay, the larva, on leaving the earth, has a fancy for the hardest places.

One of the garden-paths, converted into a little inferno by the glare from a wall facing south, abounds in such exit-holes. I proceed, in the last days of June, to examine these recently abandoned pits. The soil is so hard that I have to take my pickaxe to tackle it.

The orifices are round and nearly an inch in diameter. There is absolutely no rubbish around them, no mound of earth thrown up

outside. This is invariably the case: the Cicada's hole is never surmounted with a mole-hill, as are the burrows of the Geotrupes,[1] or Dorbeetles, those other sturdy excavators. The manner of working accounts for this difference. The Dung-beetle progresses from the outside inwards; he commences his digging at the mouth of the well, which allows him to ascend and heap up on the surface the material which he has extracted. The larva of the Cicada, on the other hand, goes from the inside outwards; the last thing that it does is to open the exit-door, which, remaining closed until the very end of the work, cannot be used for getting rid of the rubbish. The former goes in and makes a mound on the threshold of the home; the latter comes out and cannot heap up anything on a threshold that does not yet exist.

The Cicada's tunnel runs to a depth of between fifteen and sixteen inches. It is cylindrical, winds slightly, according to the exigencies of the soil, and is always nearly perpendicular, for it is shorter to go that way. The passage is quite open throughout

[1] Cf. *The Life and Love of the Insect:* chap. ix.—*Translator's Note.*

its length. It is useless to search for the rubbish which this excavation ought, one would think, to produce; we see none anywhere. The tunnel ends in a blind alley, in a rather wider chamber, with level walls and not the least vestige of communication with any gallery prolonging the well.

Reckoned by its length and its diameter, the excavation represents a volume of about twelve cubic inches. What has become of the earth removed? Sunk in very dry and very loose soil, the well and the chamber at the bottom ought to have crumbly walls, which would easily fall in, if nothing else had taken place but the work of boring. My surprise was great to find, on the contrary, coated surfaces, washed with a paste of clayey earth. They are not by a long way what one could call smooth, but at any rate their irregularities are covered with a layer of plaster; and their slippery materials, soaked with some agglutinant, are kept in position.

The larva can move about and climb nearly up to the surface and down again to its refuge at the bottom without producing, with its clawed legs, landslips which would block the tube, making ascent difficult and

retreat impossible. The miner shores up his galleries with pit-props and cross-beams; the builder of underground railways strengthens his tunnels with a casing of brickwork; the Cicada's larva, which is quite as clever an engineer, cements its shaft so as to keep it open however long it may have to serve.

If I surprise the creature at the moment when it emerges from the soil to make for a neighbouring branch and there undergo its transformation, I see it at once beat a prudent retreat and, without the slightest difficulty, run down again to the bottom of its gallery, proving that, even when the dwelling is on the point of being abandoned for good, it does not become blocked with earth.

The ascending-shaft is not a piece of work improvised in a hurry, in the insect's impatience to reach the sunlight; it is a regular manor-house, an abode in which the grub is meant to make a long stay. So the plastered walls tell us. Any such precaution would be superfluous in the case of a mere exit abandoned as soon as bored. There is not a doubt but that we have here a sort of meteorological station in which observations are taken of the weather outside. Underground, fifteen inches down, or more, the

larva ripe for its emergence is hardly able to judge whether the climatic conditions be favourable. Its subterranean weather is too gradual in its changes to be able to supply it with the precise indications necessary for the most important action of its life, its escape into the sunlight for the metamorphosis.

Patiently, for weeks, perhaps for months, it digs, clears and strengthens a perpendicular chimney, leaving at the surface, to keep it sequestered from the world without, a layer as thick as one's finger. At the bottom it makes itself a recess more carefully built than the remainder. This is its refuge, its waiting-room, where it rests if its reconnoitring lead it to defer its emigration. At the least suspicion of fine weather, it scrambles up, tests the exterior through the thin layer of earth forming a lid and enquires into the temperature and the degree of humidity of the air.

If things do not bode well, if a heavy shower threaten or a blustering storm—events of supreme importance when the delicate Cicada throws off her skin—the prudent insect slips back to the bottom of the tube and goes on waiting. If, on the other hand, the atmospheric conditions be favour-

able, then the ceiling is smashed with a few strokes of the claws and the larva emerges from the well.

Everything seems to confirm that the Cicada's gallery is a waiting-room, a meteorological station where the larva stays for a long time, now hoisting itself near the surface to discover the state of the weather, now retreating to the depths for better shelter. This explains the convenience of a resting-place at the base and the need for a strong cement on walls which, without it, would certainly give way under continual comings and goings.

What is not so easily explained is the complete disappearance of the rubbish corresponding with the space excavated. What has become of the twelve cubic inches of earth yielded by an average well? There is nothing outside to represent them, nor anything inside either. And then how, in a soil dry as cinders, is the plaster obtained with which the walls are glazed?

Larvæ that gnaw into wood, such as those of the Capricorn and the Buprestes,[1]

[1] The Capricorn, or Cerambyx-beetle, lives in oak-trees; the Buprestis-beetles are found mostly in felled timber. —*Translator's Note.*

for instance, ought to be able to answer the first question. They make their way inside a tree-trunk, boring galleries by eating the materials of the road which they open. Detached in tiny fragments by the mandibles, these materials are digested. They pass through the pioneer's body from end to end, yielding up their meagre nutritive elements on the way, and accumulate behind, completely blocking the road which the grub will never take again. The work of excessive division and subdivision, done either by the mandibles or the stomach, causes the digested materials to take up less room than the untouched wood; and the result is a space in front of the gallery, a chamber in which the grub works, a chamber which is greatly restricted in length, giving the prisoner just enough room to move about.

Can it not be in a similar fashion that the Cicada-grub bores its tunnel? Certainly the waste material flung up as it digs its way does not pass through its body; even if the soil were of the softest and most yielding character, earth plays no part whatever in the larva's food. But, after all, cannot the materials removed be simply shot back as the work proceeds? The Cicada remains

four years in the ground. This long life is not, of course, spent at the bottom of the well which we have described: this is just a place where the larva prepares for its emergence. It comes from elsewhere, doubtless from some distance. It is a vagabond, going from one root to another and driving its sucker into each. When it moves, either to escape from the upper layers, which are too cold in winter, or to settle down at a better drinking-bar, it clears a road by flinging behind it the materials broken up by its pickaxes. This is undoubtedly the method.

As with the larvæ of the Capricorn and the Buprestes, the traveller needs around him only the small amount of free room which his movements require. Damp, soft, easily compressed earth is to this larva what the digested pap is to the others. Such earth is heaped up without difficulty; it condenses and leaves a vacant space.

The difficulty is one of a different kind with the exit-well bored in a very dry soil, which offers a marked resistance to compression so long as it retains its aridity. That the larva, when beginning to dig its passage, flung back part of the excavated materials into an earlier gallery which has now disap-

peared is fairly probable, though there is nothing in the condition of things to tell us so; but, if we consider the capacity of the well and the extreme difficulty of finding room for so great a volume of rubbish, our doubts return and we say to ourselves:

"This rubbish demanded a large empty space, which itself was obtained by shifting other refuse no less difficult to house. The room required presupposes the existence of another space into which the earth extracted was shot."

And so we find ourselves in a vicious circle, for the mere subsidence of materials flung behind would not be enough to explain so great a void. The Cicada must have a special method of disposing of the superfluous earth. Let us try and surprise his secret.

Examine a larva at the moment when it emerges from the ground. It is nearly always more or less soiled with mud, sometimes wet, sometimes dry. The digging-implements, the fore-feet, have the points of their pickaxes stuck in a globule of slime; its other legs are cased in mud; its back is spotted with clay. We are reminded of a scavenger who has been stirring up sewage.

These stains are the more striking inasmuch as the creature comes out of exceedingly dry ground. We expected to see it covered with dust and we find it covered with mud.

One more step in this direction and the problem of the well is solved. I exhume a larva which happens to be working at its exit-gallery. Very occasionally, I get a piece of luck like this, in the course of my digging; it would be useless for me to try for it, as there is nothing outside to guide my search. My welcome prize is just beginning its excavations. An inch of tunnel, free from any rubbish, and the waiting-room at the bottom represent all the work for the moment. In what condition is the worker? We shall see.

The grub is much paler in colour than those which I catch as they emerge. Its big eyes in particular are whitish, cloudy, squinting and apparently of little use for seeing. What good is sight underground? The eyes of the larvæ issuing from the earth are, on the contrary, black and shining and indicate ability to see. When it makes its appearance in the sunshine, the future Cicada has to seek, occasionally at some distance from the exit-hole, the hanging

branch on which the metamorphosis will be performed; and here sight will manifestly be useful. This maturity of vision attained during the preparation for the release is enough to show us that the larva, far from hastily improvising its ascending-shaft, works at it for a long time.

Moreover, the pale and blind larva is bulkier than it is in the state of maturity. It is swollen with liquid and looks dropsical. If you take it in your fingers, a limpid humour oozes from the hinder part and moistens the whole body. Is this fluid, expelled from the intestines, a urinary product? Is it just the residue of a stomach fed solely on sap? I will not decide the question and will content myself with calling it urine, merely for convenience.

Well, this fountain of urine is the key to the mystery. The larva, as it goes on and digs, sprinkles the dusty materials and makes them into paste, which is forthwith applied to the walls by abdominal pressure. The original dryness is succeeded by plasticity. The mud obtained penetrates the interstices of a rough soil; the more liquid part of it trickles in front; the remainder is compressed and packed and occupies the empty

spaces in between. Thus is an unblocked tunnel obtained, without any refuse, because the dust and rubbish are used on the spot in the form of a mortar which is more compact and more homogeneous than the soil traversed.

The larva therefore works in the midst of clayey mire; and this is the cause of the stains that astonish us so much when we see it issuing from excessively dry soil. The perfect insect, though relieved henceforth from all mining labour, does not utterly abandon the use of its bladder; a few drains of urine are preserved as a weapon of defence. When too closely observed, it discharges a spray at the intruder and quickly flies away. In either form, the Cicada, his dry constitution notwithstanding, proves himself a skilled irrigator.

Dropsical though it be, the larva cannot carry sufficient liquid to moisten and turn into compressible mud the long column of earth which has to be tunnelled. The reservoir becomes exhausted and the supply has to be renewed. How is this done and when? I think I see.

The few wells which I have laid bare throughout their length, with the pains-

taking care which this sort of digging demands, show me at the bottom, encrusted in the wall of the terminal chamber, a live root, sometimes as big as a lead-pencil, sometimes no thicker than a straw. The visible part of this root is quite small, barely a fraction of an inch. The rest is contained in the surrounding earth. Is the discovery of this sort of sap fortuitous? Or is it the result of a special search on the larva's part? The presence of a rootlet is so frequent, at least when my digging is skilfully conducted, that I rather favour the latter alternative.

Yes, the Cicada-grub, when hollowing out its cell, the starting-point of the future chimney, seeks the immediate neighbourhood of a small live root; it lays bare a certain portion, which continues the side wall without projecting. This live spot in the wall is, I think, the fount from which the contents of the urinary bladder are renewed as the need arises. When its reserves are exhausted by the conversion of dry dust into mud, the miner goes down to his chamber, drives in his sucker and takes a deep draught from the cask built into the wall. With his jug well filled, he goes up again. He resumes his work, wetting the hard earth the

better to flatten it with his claws and reducing the dusty rubbish to mud which can be heaped up around him and leave a clear thoroughfare. That is how things must happen. So logic and the circumstances of the case tell us, in the absence of direct observation, which is not feasible here.

If this root-cask fail, if moreover the reservoir of the intestine be exhausted, what will happen then? We shall learn from the following experiment. I catch a grub as it is leaving the ground. I put it at the bottom of a test-tube and cover it with a column of dry earth, not too closely packed. The column is nearly six inches high. The larva has just quitted an excavation thrice as deep, in soil of the same nature, but offering a much greater resistance. Now that it is buried under my short, sandy column, will it be capable of climbing to the surface? If it were a mere matter of strength, the issue would be certain. What can an obstacle without cohesion be to one that has just bored a hole through the hard ground?

And yet I am assailed by doubts. To break down the screen that still separated it from the outer air, the larva has expended its last reserves of fluid. The flask is dry;

and there is no way of replenishing it in the absence of a live root. My suspicion of failure is well-founded. For three days I see the entombed one wasting itself in efforts without succeeding in rising an inch higher. The materials removed refuse to stay in position for lack of anything to bind them; they are no sooner pushed aside than they slip down again under the insect's legs. The labour has no perceptible result and has always to be done all over again. On the fourth day, the creature dies.

With the water-can full, the result is quite different. I subject to the same experiment an insect whose work of self-deliverance is just beginning. It is all swollen with urinary humours which ooze out and moisten its whole body. This one's task is easy. The materials offer hardly any resistance. A little moisture, supplied by the miner's flask, converts them into mud, sticks them together and keeps them out of the way. The passage is opened, very irregular in shape, it is true, and almost filled up at the back as the ascent proceeds. It is as though the larva, recognizing the impossibility of renewing its store of fluid, were saving up the little which it possesses and spending no

more than is strictly necessary to enable it to escape as quickly as possible from its unfamiliar surroundings. This economy is so well arranged that the insect reaches the surface at the end of ten days.

CHAPTER III

THE CICADA: THE TRANSFORMATION

THE exit-gate is passed and left wide open, like a hole made with a large gimlet. For some time the larva wanders about the neighbourhood, looking for some aerial support, a tiny bush, a tuft of thyme, a blade of grass or the twig of a shrub. It finds it, climbs up and, head upwards, clings to it firmly with the claws of the fore-feet, which close and do not let go again. The other legs take part in sustaining it, if the position of the branch make this possible; if not, the two claws suffice. There follows a moment of rest to allow the supporting arms to stiffen into an immovable grip.

First, the mesothorax splits along the middle of the back. The edges of the slit separate slowly and reveal the pale-green colour of the insect. Almost immediately afterwards, the prothorax splits also. The longitudinal fissure reaches the back of the

head above and the metathorax below, without spreading farther. The wrapper of the skull breaks crosswise, in front of the eyes; and the red stemmata appear. The green portion uncovered by these ruptures swells and protrudes over the whole of the mesothorax. We see slow palpitations, alternate contractions and distensions due to the ebb and flow of the blood. This hernia, working at first out of sight, is the wedge that made the cuirass split along two crossed lines of least resistance.

The skinning-operation makes rapid progress. Soon the head is free. Then the rostrum and the front legs gradually leave their sheaths. The body is horizontal, with the ventral surface turned upwards. Under the wide-open carapace appear the hinder legs, the last to be released. The wings are distended with moisture. They are still rumpled and look like stumps bent into a bow. This first phase of the transformation has taken but ten minutes.

There remains the second, which lasts longer. The whole of the insect is free, except the tip of the abdomen, which is still contained in its scabbard. The cast skin continues to grip the twig. Stiffening as the

result of quick desiccation, it preserves without change the attitude which it had at the start. It forms the pivot for what is about to follow.

Fixed to his slough by the tip of the abdomen, which is not yet extracted, the Cicada turns over perpendicularly, head downwards. He is pale-green, tinged with yellow. The wings, until now compressed into thick stumps, straighten out, unfurl, spread under the rush of the liquid with which they are gorged. When this slow and delicate operation is ended, the Cicada, with an almost imperceptible movement, draws himself up by sheer strength of loin and resumes a normal position, head upwards. The fore-legs hook on to the empty skin; and at last the tip of the belly is drawn from its sheath. The extraction is over. The work has required half an hour altogether.

Here is the whole insect, freed from its mask, but how different from what it will be presently! The wings are heavy, moist, transparent, with their veins a light green. The prothorax and mesothorax are barely tinged with brown. All the rest of the body is pale-green, whitish in places. It must

bathe in air and sunshine for a long time before strength and colour can come to its frail body. About two hours pass without producing any noticeable change. Hanging to his cast skin by his fore-claws only, the Cicada sways at the least breath of air, still feeble and still green. At last the brown tinge appears, becomes more marked and is soon general. Half an hour has effected the change of colour. Slung from the suspension-twig at nine o'clock in the morning, the Cicada flies away, before my eyes, at half-past twelve.

The cast skin remains, intact, save for its fissure, and so firmly fastened that the rough weather of autumn does not always succeed in bringing it to the ground. For some months yet, even during the winter, one often meets old skins hanging in the bushes in the exact position adopted by the larva at the moment of its transformation. Their horny nature, something like dry parchment, ensures a long existence for these relics.

Let us hark back for a moment to the gymnastic feat which enables the Cicada to leave his scabbard. At first retained by the tip of the abdomen, which is the last part to remain in its case, the Cicada turns over

perpendicularly, head downwards. This somersault allows him to free his wings and legs, after the head and chest have already made their appearance by cracking the armour under the pressure of a hernia. Now comes the time to free the end of the abdomen, the pivot of this inverted attitude. For this purpose, the insect, with a laborious movement of its back, draws itself up, brings its head to the top again and hooks itself with its fore-claws to the cast skin. A fresh support is thus obtained, enabling it to pull the tip of its abdomen from its sheath.

There are therefore two means of support: first the end of the belly and then the front claws; and there are two principal movements: in the first place the downward somersault, in the second place the return to the normal position. These gymnastics demand that the larva shall fix itself to a twig, head upwards, and that it shall have a free space beneath it. Suppose that these conditions were lacking, thanks to my wiles: what would happen? That remained to be seen.

I tie a thread to the end of one of the hind-legs and hang the larva up in the peaceful atmosphere of a test-tube. My thread

is a plumb-line which will remain vertical, for there is nothing to interfere with it. In this unwonted posture, which places its head at the bottom at a time when the near approach of the transformation demands that it should be at the top, the unfortunate creature for a long time kicks about and struggles, striving to turn over and to seize with its fore-claws either the thread by which it hangs or one of its own hind-legs. Some of them succeed in their efforts, draw themselves up as best they can, fasten themselves as they wish, despite the difficulty of keeping their balance, and effect their metamorphosis without impediment.

Others wear themselves out in vain. They do not catch hold of the thread, they do not bring their heads upwards. Then the transformation is not accomplished. Sometimes the dorsal rupture takes place, leaving bare the mesothorax swollen into a hernia, but the shelling proceeds no farther and the insect soon dies. More often still the larva perishes intact, without the least fissure.

Another experiment. I place the larva in a glass jar with a thin bed of sand, which makes progress possible. The animal moves along, but is not able to hoist itself up any-

where: the slippery sides of the glass prevent this. Under these conditions, the captive expires without trying to transform itself. I have known exceptions to this miserable ending; I have sometimes seen the larva undergo a regular metamorphosis on a layer of sand thanks to peculiarities of equilibrium which were very difficult to distinguish. In the main, when the normal attitude or something very near it is impossible, metamorphosis does not take place and the insect succumbs. That is the general rule.

This result seems to tell us that the larva is capable of opposing the forces which are at work in it when the transformation is at hand. A cabbage-silique, a pea-pod invariably burst to set free their seeds. The Cicada-larva, a sort of pod containing, by way of seed, the perfect insect, is able to control its dehiscence, to defer it until a more opportune moment and even to suppress it altogether in unfavourable circumstances. Convulsed by the profound revolution that takes place in its body on the point of transfiguration, but at the same time warned by instinct that the conditions are not good, the insect makes a desperate resistance and dies rather than consent to open.

Apart from the trials to which my curiosity subjects it, I do not see that the Cicada-larva is exposed to any danger of perishing in this way. There is always a bit of brushwood of some kind near the exit-hole. The newly-exhumed insect climbs on it; and a few minutes are enough for the animal pod to split down the back. This swift hatching has often been a source of trouble to me in my studies. A larva appears on the hills not far from my house. I catch sight of it just as it is fastening on the twig. It would form an interesting subject of observation indoors. I place it in a paper bag, together with the stick that carries it, and hurry home. This takes me a quarter of an hour, but it is labour lost: by the time that I arrive, the green Cicada is almost free. I shall not see what I was bent on seeing. I had to abandon this method of obtaining information and be content with an occasional lucky find within a few yards of my door.

"Everything is in everything," as Jacotot the pedagogue [1] used to say. In connection

[1] Joseph Jacotot (1770-1840), a famous French educator, whose methods aroused a great deal of discussion. He propounded other more or less paradoxical maxims, such as, "All men have an equal intelligence," "A man can teach what he does not know," and so on. —*Translator's Note.*

with that remarkably quick metamorphosis a culinary question arises. According to Aristotle, Cicadæ were a highly-appreciated dish among the Greeks. I am not acquainted with the great naturalist's text: humble villager that I am, my library possesses no such treasure. I happen, however, to have before me a venerable tome which can tell me just what I want to know. I refer to Matthiolus' *Commentaries on Dioscorides*.[1] As an eminent scholar, who must have known his Aristotle very well, Matthiolus inspires me with complete confidence. Now he says:

"Mirum non est quod dixerit Aristoteles, cicadas esse gustu suavissimas antequam tettigometræ rumpatur cortex."

Knowing that *tettigometra,* or mother of the Cicada, is the expression used by the ancients to denote the larva, we see that, according to Aristotle, the Cicadæ possess a flavour most delicious to the taste before the bark or outer covering of the matrix bursts.

[1] Pietro Andrea Mattioli (1500-1577), known as Matthiolus, a physician and naturalist who practised at Siena and Rome. His *Commentaries on Dioscorides* were published in Italian, at Venice, in 1544 and in Latin in 1554.—*Translator's Note.*

This detail of the unbroken covering tells us at what season the toothsome dainty should be picked. It cannot be in winter, when the earth is dug deep by the plough, for at that time there is no danger of the larva's hatching. People do not recommend an utterly superflous precaution. It is therefore in summer, at the period of the emergence from underground, when a good search will discover the larvæ, one by one, on the surface of the soil. This is the real moment to take care that the wrapper is unbroken. It is the moment also to hasten the gathering and the preparations for cooking: in a very few minutes the wrapper will burst.

Are the ancient culinary reputation and that appetizing epithet, *suavissimas gustu,* well-deserved? We have an excellent opportunity: let us profit by it and restore to honour, if the occasion warrant it, the dish extolled by Aristotle. Rondelet,[1] Rabelais' erudite friend, gloried in having rediscо-

[1] Guillaume Rondelet (1507-1566), a physician and naturalist, author of various works on medicine and of an *Universa piscium historia* (Lyons, 1554) which earned him the title of father of ichthyology. Rabelais introduces him into his *Pantagruel* by the name of Rondibilis. —*Translator's Note.*

vered *garum,* the famous sauce made from the entrails of rotten fish. Would it not be a meritorious work to give the epicures their *tettigometræ* again?

On a morning in July, when the sun is up and has invited the Cicadæ to leave the ground, the whole household, big and little, go out searching. There are five of us engaged in exploring the enclosure, especially the edges of paths, which yield the best results. To prevent the skin from bursting, as each larva is found I dip it into a glass of water. Asphyxia will stay the work of metamorphosis. After two hours of careful seeking, when every forehead is streaming with perspiration, I am the owner of four larvæ, no more. They are dead or dying in their preserving bath; but this does not matter, since they are destined for the frying-pan.

The method of cooking is of the simplest, so as to alter as little as possible the flavour reputed to be so exquisite: a few drops of oil, a pinch of salt, a little onion and that is all. There is no conciser recipe in the whole of *La Cuisinière bourgeoise.* At dinner, the fry is divided fairly among all of us hunters.

The stuff is unanimously admitted to be eatable. True, we are people blessed with good appetites and wholly unprejudiced stomachs. There is even a slightly shrimpy flavour which would be found in a still more pronounced form in a *brochette* of Locusts. It is, however, as tough as the devil and anything but succulent; we really feel as if we were chewing bits of parchment. I will not recommend to anybody the dish extolled by Aristotle.

Certainly, the renowned animal-historian was remarkably well-informed as a rule. His royal pupil sent on his behalf to India, the land at that time so full of mystery, for the curiosities most impressive to Macedonian eyes; he received by caravan the Elephant, the Panther, the Tiger, the Rhinoceros, the Peacock; and he described them faithfully. But, in Macedonia itself, he knew the insect only through the peasant, that stubborn tiller of the soil, who found the *tettigometra* under his spade and was the first to know that a Cicada comes out of it. Aristotle, therefore, in his immense undertaking, was doing more or less what Pliny was to do later, with a much greater amount of artless credulity. He listened to

the chit-chat of the country-side and set it down as veracious history.

Rustic waggery is world-famous. The countryman is always ready to jeer at the trifles which we call science; he laughs at whoso stops to examine an insignificant insect; he goes into fits of laughter if he sees us picking up a pebble, looking at it and putting it in our pocket. The Greek peasant excelled in this sort of thing. He told the townsman that the *tettigometra* was a dish fit for the gods, of an incomparable flavour, *suavissima gustu*. But, while making his victim's mouth water with hyperbolical praises, he put it out of his power to satisfy his longings, by laying down the essential condition that he must gather the delicious morsel before the shell had burst.

I should like to see any one try to get together the material for a sufficiently copious dish by gathering a few handfuls of *tettigometræ* just coming out of the earth, when my squad of five took two hours to find four larvæ on ground rich in Cicadæ. Above all, mind that the skin does not break during your search, which will last for days and days, whereas the bursting takes place in a few minutes. My opinion

is that Aristotle never tasted a fry of *tettigometræ;* and my own culinary experience is my witness. He is repeating some rustic jest in all good faith. His heavenly dish is too horrible for words.

Oh, what a fine collection of stories I too could make about the Cicada, if I listened to all that my neighbours the peasants tell me! I will give one particular of his history and one alone, as related in the country.

Have you any renal infirmity? Are you dropsical at all? Do you need a powerful depurative? The village pharmacopœia is unanimous in suggesting the Cicada as a sovran remedy. The insects are collected in summer, in their adult form. They are strung together and dried in the sun and are fondly preserved in a corner of the press. A housewife would think herself lacking in prudence if she allowed July to pass without threading her store of them.

Do you suffer from irritation of the kidneys, or perhaps from stricture? Quick, have some Cicada-tea! Nothing, they tell me, is so efficacious. I am duly grateful to the good soul who once, as I have since heard, made me drink a concoction of the sort, without my knowing it, for some

trouble or other; but I remain profoundly incredulous. I am struck, however, by the fact that the same specific was recommended long ago by Dioscorides. The old Cilician doctor tells us:

"Cicadæ, quæ inassatæ manduntur, vesicæ doloribus prosunt." [1]

Ever since the far-off days of this patriarch of *materia medica,* the Provençal peasant has retained his faith in the remedy revealed to him by the Greeks who brought the olive, the fig-tree and the vine from Phocæa. One thing alone is changed: Dioscorides advises us to eat our Cicadæ roasted; nowadays they are boiled and taken as an infusion.

The explanation given of the insect's diuretic properties is wonderfully ingenuous. The Cicada, as all of us here know, shoots a sudden spray of urine, as it flies away, in the face of any one who tries to take hold of it. He is therefore bound to hand on his powers of evacuation to us. Thus must Dioscorides and his contemporaries have

[1] "Cicadæ eaten roasted are good for pains in the bladder."

argued; and thus does the peasant of Provence argue to this day.

O my worthy friends, what would you say if you knew the virtues of the *tettigometra,* which is capable of mixing mortar with its urine to build a meteorological station withal! You would be driven to borrow the hyperbole of Rabelais, who shows us Gargantua seated on the towers of Notre-Dame and drowning with the deluge from his mighty bladder so many thousand Paris loafers, not to mention the women and children!

CHAPTER IV

THE CICADA: HIS MUSIC

BY his own confession, Réaumur never heard the Cicada sing; he never saw the insect alive. It reached him from the country round Avignon preserved in spirits and a goodly supply of sugar. These conditions were enough to enable the anatomist to give an exact description of the organ of sound; nor did the master fail to do so: his penetrating eye clearly discerned the construction of the strange musical-box, so much so that his treatise upon it has become the fountain-head for any one who wants to say a few words about the Cicada's song.

With him the harvest was gathered; it but remains to glean a few ears which the disciple hopes to make into a sheaf. I have more than enough of what Réaumur lacked: I hear rather more of these deafening symphonists than I could wish; and so I shall perhaps obtain a little fresh light on a sub-

ject that seems exhausted. Let us therefore go back to the question of the Cicada's song, repeating only so much of the data acquired as may be necessary to make my explanation clear.

In my neighbourhood I can capture five species of Cicadæ, namely, *Cicada plebeia,* LIN.; *C. orni,* LIN.; *C. hematodes,* LIN.; *C. atra,* OLIV.; and *C. pygmæa,* OLIV. The first two are extremely common; the three others are rarities, almost unknown to the country-folk.

The Common Cicada is the biggest of the five, the most popular and the one whose musical apparatus is usually described. Under the male's chest, immediately behind the hind-legs, are two large semicircular plates, overlapping each other slightly, the right plate being on the top of the left. These are the shutters, the lids, the dampers, in short the *opercula* of the organ of sound. Lift them up. You then see opening, on either side, a roomy cavity, known in Provence by the name of the chapel (*li capello*). The two together form the church (*la glèiso*). They are bounded in front by a soft, thin, creamy-yellow membrane; at the back by a dry pellicle, iridescent as a soap-

bubble and called the mirror (*mirau*) in the Provençal tongue.

The church, the mirrors and the lids are commonly regarded as the sound-producing organs. Of a singer short of breath it is said that he has cracked his mirrors (*a li mirau creba*). Picturesque language says the same thing of an uninspired poet. Acoustics give the lie to the popular belief. You can break the mirrors, remove the lids with a cut of the scissors, tear the yellow front membrane and these mutilations will not do away with the Cicada's song: they simply modify it, weaken it slightly. The chapels are resonators. They do not produce sound, they increase it by the vibrations of their front and back membranes; they change it as their shutters are opened more or less wide.

The real organ of sound is seated elsewhere and is not easy to find, for a novice. On the other side of each chapel, at the ridge joining the belly to the back, is a slit bounded by horny walls and masked by the lowered lid. Let us call it the window. This opening leads to a cavity or sound-chamber deeper than the adjacent chapel, but much less wide. Immediately behind the attachment of the

rear wings is a slight, almost oval protuberance, which is distinguished by its dull-black colour from the silvery down of the surrounding skin. This protuberance is the outer wall of the sound-chamber.

Let us make a large cut in it. We now lay bare the sound-producing apparatus, the cymbal. This is a little dry, white membrane, oval-shaped, convex on the outside, crossed from end to end of its longer diameter by a bundle of three or four brown nervures, which give it elasticity, and fixed all round in a stiff frame. Imagine this bulging scale to be pulled out of shape from within, flattening slightly and then quickly recovering its original convexity owing to the spring of its nervures. The drawing in and blowing out will produce a clicking sound.

Twenty years ago, all Paris went mad over a silly toy called the Cricket, or *Cri-cri,* if I remember rightly. It consisted of a short blade of steel, fastened at one end to a metallic base. Alternately pressed out of shape with the thumb and then released, the said blade, though possessing no other merit, gave out a very irritating click; and nothing more was needed to make it popular. The

Cricket's vogue is over. Oblivion has done justice to it so drastically that I doubt if I shall be understood when I recall the once famous apparatus.

The membranous cymbal and steel Cricket are similar instruments. Both are made to rattle by pushing an elastic blade out of shape and restoring it to its original condition. The Cricket was bent out of shape with the thumb. How is the convexity of the cymbals modified? Let us go back to the church and break the yellow curtain that marks the boundary of each chapel in front. Two thick muscular columns come in sight, of a pale orange colour, joined together in the form of a V, with its point standing on the insect's median line, on the lower surface. Each of these fleshy columns ends abruptly at the top, as though lopped off; and from the truncated stump rises a short, slender cord which is fastened to the side of the corresponding cymbal.

There you have the whole mechanism, which is no less simple than that of the metal Cricket. The two muscular columns contract and relax, shorten and lengthen. By means of the terminal thread each tugs at its cymbal, pulling it down and forthwith let-

ting it spring back of itself. Thus are the two sound-plates made to vibrate.

Would you convince yourself of the efficacy of this mechanism? Would you make a dead but still fresh Cicada sing? Nothing could be simpler. Seize one of the muscular columns with the pincers and jerk it gently. The dead *Cri-cri* comes to life again; each jerk produces the clash of the cymbal. The sound is very feeble, I admit, deprived of the fulness which the living virtuoso obtains with the aid of his sound-chambers; nevertheless the fundamental element of the song is produced by this anatomical trick.

Would you on the other hand silence a live Cicada, that obstinate melomaniac who, when you hold him prisoner in your fingers, bewails his sad lot as garrulously as, just now, he sang his joys in the tree? It is no use to break open his chapels, to crack his mirrors: the shameful mutilation would not check him. But insert a pin through the side slit which we have called the window and touch the cymbal at the bottom of the sound-chamber. A tiny prick; and the perforated cymbal is silent. A similar operation on the other side renders the insect mute, though it remains as vigorous as before, showing

no perceptible wound. Any one unacquainted with the method of procedure stands amazed at the result of my pin-prick, when the utter destruction of the mirrors and the other accessories of the church does not produce silence. A tiny and in no way serious stab has an effect which is not caused even by evisceration.

The lids, those firmly fitted plates, are stationary. It is the abdomen itself which, by rising and falling, causes the church to open and shut. When the abdomen is lowered, the lids cover the chapels exactly, together with the windows of the sound-chambers. The sound is then weakened, muffled, stifled. When the abdomen rises, the chapels open, the windows are unobstructed and the sound acquires its full strength. The rapid oscillations of the belly, therefore, synchronizing with the contractions of the motor-muscles of the cymbals, determine the varying volume of the sound, which seems to come from hurried strokes of a bow.

When the weather is calm and warm, about the middle of the day, the Cicada's song is divided into strophes of a few seconds' duration, separated by short pauses.

The strophe begins abruptly. In a rapid crescendo, the abdomen oscillating faster and faster, it acquires its maximum volume; it keeps up the same degree of strength for a few seconds and then becomes gradually weaker and degenerates into a tremolo which decreases as the belly relapses into rest. With the last pulsations of the abdomen comes silence, which lasts for a longer or shorter time according to the condition of the atmosphere. Then suddenly we hear a new strophe, a monotonous repetition of the first; and so on indefinitely.

It often happens, especially during the sultry evening hours, that the insect, drunk with sunshine, shortens and even entirely suppresses the pauses. The song is then continuous, but always with alternations of *crescendo* and *decrescendo*. The first strokes of the bow are given at about seven or eight o'clock in the morning; and the orchestra ceases only with the dying gleams of the twilight, at about eight o'clock in the evening. Altogether the concert lasts the whole round of the clock. But, if the sky be overcast, if the wind blow cold, the Cicada is dumb.

The second species is only half the size

of the Common Cicada and is known in the district by the name of the *Cacan,* a fairly accurate imitation of his peculiar rattle. This is the Ash Cicada of the naturalists; and he is far more alert and more suspicious than the first. His harsh loud song consists of a series of *Can! Can! Can! Can!* with not a pause to divide the ode into strophes. Its monotony and its harsh shrillness make it a most unpleasant ditty, especially when the orchestra is composed of some hundreds of executants, as happens in my two plane-trees during the dog-days. At such times it is as though a heap of dry walnuts were being shaken in a bag until the shells cracked. This irritating concert, a veritable torment, has only one slight advantage about it: the Ash Cicada does not start quite so early in the morning as the Common Cicada and does not sit up so late at night.

Although constructed on the same fundamental principles, the vocal apparatus displays numerous peculiarities which give the song its special character. The sound-chamber is entirely lacking, which means that there is no entrance-window either. The cymbal is uncovered, just behind the insertion of the hind-wing. It again is a dry, white

scale, convex on the outside and crossed by a bundle of five red-brown nervures.

The first segment of the abdomen thrusts forward a short, wide tongue, which is quite rigid and of which the free end rests on the cymbal. This tongue may be compared with the blade of a rattle which, instead of fitting into the teeth of a revolving wheel, touches the nervures of the vibrating cymbal more or less closely. The harsh, grating sound must, I think, be partly due to this. It is hardly possible to verify the fact when holding the creature in our fingers: the startled *Cacan* does anything at such times rather than emit his normal song.

The lids do not overlap; on the contrary, they are separated by a rather wide interval. With the rigid tongues, those appendages of the abdomen, they shelter one half of the cymbals, the other half of which is quite bare. The abdomen, when pressed with the finger, does not open to any great extent where it joins the thorax. For the rest, the insect keeps still when it sings; it knows nothing of the rapid quivering of the belly that modulates the song of the Common Cicada. The chapels are very small and almost negligible as sounding-boards. There

are mirrors, it is true, but insignificant ones, measuring scarcely a twenty-fifth of an inch. In short, the mechanism of sound, which is so highly developed in the Common Cicada, is very rudimentary here. How then does the thin clash of the cymbals manage to gain in volume until it becomes intolerable?

The Ash Cicada is a ventriloquist. If we examine the abdomen by holding it up to the light, we see that the front two thirds are translucent. Let us snip off the opaque third part that retains, reduced to the strictly indispensable, the organs essential to the propagation of the species and the preservation of the individual. The rest of the belly is wide open and presents a spacious cavity, with nothing but its tegumentary walls, except in the case of the dorsal surface, which is lined with a thin layer of muscle and serves as a support to the slender digestive tube, which is little more than a thread. The large receptacle, forming nearly half of the insect's total bulk, is therefore empty, or nearly so. At the back are seen the two motor pillars of the cymbals, the two muscular columns arranged in a V. To the right and left of the point of this V gleam the two tiny mirrors; and the empty space is

continued between the two branches into the depths of the thorax.

This hollow belly and its thoracic complement form an enormous resonator, unapproached by that of any other performer in our district. If I close with my finger the orifice in the abdomen which I have just clipped, the sound becomes lower, in conformity with the laws affecting organ-pipes; if I fit a cylinder, a screw of paper, to the mouth of the open belly, the sound becomes louder as well as deeper. With a paper funnel properly adjusted, its wide end thrust into the mouth of a test-tube acting as a sounding-board, we have no longer the shrilling of the Cicada but something very near the bellowing of a Bull. My small children, happening to be there at the moment when I am making my acoustic experiments, run away scared. The familiar insect inspires them with terror.

The harshness of the sound appears to be due to the tongue of the rattle rasping the nervures of the vibrating cymbals; its intensity may no doubt be ascribed to the spacious sounding-board of the belly. Assuredly one must be passionately enamoured of song thus to empty one's belly and chest in order

to make room for a musical-box. The essential vital organs are reduced to the minimum, are confined to a tiny corner, so as to leave a greater space for the sounding-cavity. Song comes first; all the rest takes second place.

It is a good thing that the Ash Cicada does not follow the teaching of the evolutionists. If, becoming more enthusiastic from generation to generation, he were able by progressive stages to acquire a ventral sounding-board fit to compare with that which my paper screws give him, my Provence, peopled as it is with *Cacans,* would one day become uninhabitable.

After the details which I have already given concerning the Common Cicada, it seems hardly necessary to say how the insupportable chatterbox of the Ash is rendered dumb. The cymbals are clearly visible on the outside. You prick them with the point of a needle. Complete silence follows instantly. Why are there not in my plane-trees, among the dagger-wearing insects, auxiliaries who, like myself, love quiet and who would devote themselves to that task! A mad wish! A note would then be lacking in the majestic harvest symphony.

The Red Cicada (*C. hematodes*) is a little smaller than the Common Cicada. He owes his name to the blood-red colour that takes the place of the other's brown on the veins of the wings and some other lineaments of the body. He is rare. I come upon him occasionally in the hawthorn-bushes. As regards his musical apparatus, he stands half-way between the Common Cicada and the Ash Cicada. He has the former's oscillation of the belly, which increases or reduces the strength of the sound by opening or closing the church; he possesses the latter's exposed cymbals, unaccompanied by any sound-chamber or window.

The cymbals therefore are bare, immediately after the attachment of the hind-wings. They are white, fairly regular in their convexity and boast eight long, parallel nervures of a ruddy brown and seven others which are much shorter and which are inserted singly in the intervals between the first. The lids are small and scolloped at their inner edge so as to cover only half of the corresponding chapel. The opening left by the hollow in the lid has as a shutter a little pallet fixed to the base of the hind-leg, which, by folding itself against the body or lifting slightly,

keeps the aperture either shut or open. The other Cicadæ have each a similar appendage, but in their case it is narrower and more pointed.

Moreover, as with the Common Cicada, the belly moves freely up and down. This heaving movement, combined with the play of the femoral pallets, opens and closes the chapels to varying extents.

The mirrors, though not so large as the Common Cicada's, have the same appearance. The membrane that faces them on the thorax side is white, oval and very delicate and is tight-stretched when the abdomen is raised and flabby and wrinkled when the abdomen is lowered. In its tense state it seems capable of vibration and of increasing the sound.

The song, modulated and subdivided into strophes, suggests that of the Common Cicada, but is much less objectionable. Its lack of shrillness may well be due to the absence of any sound-chambers. Other things being equal, cymbals vibrating uncovered cannot possess the same intensity of sound as those vibrating at the far end of an echoing vestibule. The noisy Ash Cicada also, it is true, lacks that vestibule; but he

amply makes up for its absence by the enormous resonator of his belly.

I have never seen the third Cicada, sketched by Réaumur and described by Olivier [1] under the name of *C. tomentosa.* The species is known in Provence, so this and that one tells me, by the name of the *Cigalon,* or rather *Cigaloun,* the Little Cigale or Cicada. This designation is unknown in my neighbourhood.

I possess two other specimens which Réaumur probably confused with the one of which he gives us a drawing. One is the Black Cicada (*C. atra,* OLIV.), whom I came across only once; the other is the Pigmy Cicada (*C. pygmæa,* OLIV.), whom I have picked up pretty often. I will say a few words about this last one.

He is the smallest member of the genus in my district, the size of an average Gad-fly, and measures about three-quarters of an inch in length. His cymbals are transparent, with three opaque veins, are scarcely sheltered by

[1] Guillaume Antoine Olivier (1756-1814), a distinguished French entomologist, author of an *Histoire naturelle des coléoptères,* in six volumes (1789-1808), and part author of the nine volumes devoted to a *Dictionnaire de l'histoire naturelle des insectes* in the *Encyclopédie méthodique* (1789-1819).—*Translator's Note.*

a fold in the skin and are in full view, without any sort of entrance-lobby or sound-chamber. I may remark, in terminating our survey, that the entrance-lobby exists only in the Common Cicada; all the others are without it.

The dampers are separated by a wide interval and allow the chapels to open wide. The mirrors are comparatively large. Their shape suggests the outline of a kidney-bean. The abdomen does not heave when the insect sings; it remains stationary, like the Ash Cicada's. Hence a lack of variety in the melody of both.

The Pigmy Cicada's song is a monotonous rattle, pitched in a shrill key, but faint and hardly perceptible a few steps away in the calm of our enervating July afternoons. If ever a fancy seized him to forsake his sun-scorched bushes and to come and settle down in force in my cool plane-trees—and I wish that he would, for I should much like to study him more closely—this pretty little Cicada would not disturb my solitude as the frenzied *Cacan* does.

We have now ploughed our way through the descriptive part; we know the instrument of sound so far as its structure is concerned.

In conclusion, let us ask ourselves the object of these musical orgies. What is the use of all this noise? One reply is bound to come: it is the call of the males summoning their mates; it is the lovers' cantata.

I will allow myself to discuss this answer, which is certainly a very natural one. For fifteen years the Common Cicada and his shrill associate, the *Cacan,* have thrust their society upon me. Every summer for two months I have them before my eyes, I have them in my ears. Though I may not listen to them gladly, I observe them with a certain zeal. I see them ranged in rows on the smooth bark of the plane-trees, all with their heads upwards, both sexes interspersed with a few inches between them.

With their suckers driven into the tree, they drink, motionless. As the sun turns and moves the shadow, they also turn around the branch with slow lateral steps and make for the best-lighted and hottest surface. Whether they be working their suckers or moving their quarters, they never cease singing.

Are we to take the endless cantilena for a passionate call? I am not sure. In the assembly the two sexes are side by side; and

you do not spend months on end in calling to some one who is at your elbow. Then again, I never see a female come rushing into the midst of the very noisiest orchestra. Sight is enough as a prelude to marriage here, for it is excellent; the wooer has no use for an everlasting declaration: the wooed is his next-door neighbour.

Could it be a means then of charming, of touching the indifferent one? I still have my doubts. I notice no signs of satisfaction in the females; I do not see them give the least flutter nor sway from side to side, though the lovers clash their cymbals never so loudly.

My neighbours the peasants say that, at harvest-time, the Cicada sings, "*Sego, sego, sego!* Reap, reap, reap!" to encourage them to work. Whether harvesters of wheat or harvesters of thought, we follow the same occupation, one for the bread of the stomach, the other for the bread of the mind. I can understand their explanation, therefore; and I accept it as an instance of charming simplicity.

Science asks for something better; but she finds in the insect a world that is closed to us. There is no possibility of divining or even

suspecting the impression produced by the clash of the cymbals upon those who inspire it. All that I can say is that their impassive exterior seems to denote complete indifference. Let us not insist too much: the private feelings of animals are an unfathomable mystery.

Another reason for doubt is this: those who are sensitive to music always have delicate hearing; and this hearing, a watchful sentinel, should give warning of any danger at the least sound. The birds, those skilled songsters, have an exquisitely fine sense of hearing. Should a leaf stir in the branches, should two wayfarers exchange a word, they will be suddenly silent, anxious, on their guard. How far the Cicada is from such sensibility!

He has very clear sight. His large faceted eyes inform him of what happens on the right and what happens on the left; his three stemmata, like little ruby telescopes, explore the expanse above his head. The moment he sees us coming, he is silent and flies away. But place yourself behind the branch on which he is singing, arrange so that you are not within reach of the five visual organs; and then talk, whistle, clap

your hands, knock two stones together. For much less than this, a bird, though it would not see you, would interrupt its singing and fly away terrified. The imperturbable Cicada goes on rattling as though nothing were afoot.

Of my experiments in this matter, I will mention only one, the most memorable. I borrow the municipal artillery, that is to say, the mortars which are made to thunder forth on the feast of the patron-saint. The gunner is delighted to load them for the benefit of the Cicadæ and to come and fire them off at my place. There are two of them, crammed as though for the most solemn rejoicings. No politician making the circuit of his constituency in search of re-election was ever honoured with so much powder. We are careful to leave the windows open, to save the panes from breaking. The two thundering engines are set at the foot of the plane-trees in front of my door. No precautions are taken to mask them: the Cicadæ singing in the branches overhead cannot see what is happening below.

We are an audience of six. We wait for a moment of comparative quiet. The num-

ber of singers is checked by each of us, as are the depth and rhythm of the song. We are now ready, with ears pricked up to hear what will happen in the aerial orchestra. The mortar is let off, with a noise like a genuine thunder-clap.

There is no excitement whatever up above. The number of executants is the same, the rhythm is the same, the volume of sound the same. The six witnesses are unanimous: the mighty explosion has in no way affected the song of the Cicadæ. And the second mortar gives an exactly similar result.

What conclusion are we to draw from this persistence of the orchestra, which is not at all surprised or put out by the firing of a gun? Am I to infer from it that the Cicada is deaf? I will certainly not venture so far as that; but, if any one else, more daring than I, were to make the assertion, I should really not know what arguments to employ in contradicting him. I should be obliged at least to concede that the Cicada is extremely hard of hearing and that we may apply to him the familiar saying, to bawl like a deaf man.

When the Blue-winged Locust takes his luxurious fill of sunshine on a gravelly path

and with his great hind-shanks rubs the rough edge of his wing-cases; when the Green Tree-frog, suffering from as chronic a cold as the *Cacan,* swells his throat among the leaves and distends it into a resounding bladder at the approach of a storm, are they both calling to their absent mates? By no means. The bow-strokes of the first produce hardly a perceptible stridulation; the throaty exuberance of the second is no more effective: the object of their desire does not come.

Does the insect need these sonorous outbursts, these loquacious avowals, to declare its flame? Consult the vast majority, whom the meeting of the two sexes leaves silent. I see in the Grasshopper's fiddle, the Tree-frog's bagpipes and the cymbals of the *Cacan* but so many methods of expressing the joy of living, the universal joy which every animal species celebrates after its kind.

If any one were to tell me that the Cicadæ strum on their noisy instruments without giving a thought to the sound produced and for the sheer pleasure of feeling themselves alive, just as we rub our hands in a moment of satisfaction, I should not be greatly

shocked. That there may be also a secondary object in their concert, an object in which the dumb sex is interested, is quite possible, quite natural, though this has not yet been proved.

CHAPTER V

THE CICADA: THE LAYING AND THE HATCHING OF THE EGGS

THE Common Cicada entrusts her eggs to small dry branches. All those which Réaumur examined and found to be thus tenanted were derived from the mulberry-tree: a proof that the person commissioned to collect these eggs in the Avignon district was very conservative in his methods of search. In addition to the mulberry-tree, I, on the other hand, find them on the peach, the cherry, the willow, the Japanese privet and other trees. But these are exceptions. The Cicada really favours something different. She wants, as far as possible, tiny stalks, which may be anything from the thickness of a straw to that of a lead-pencil, with a thin ring of wood and plenty of pith. So long as these conditions are fulfilled, the actual plant matters little. I should have to draw up a list of all the semiligneous flora

of the district were I to try and catalogue the different supports used by the Cicada when laying her eggs. I shall content myself with naming a few of them in a note, to show the variety of sites of which she avails herself.[1]

The sprig occupied is never lying on the ground; it is in a position more or less akin to the perpendicular, most often in its natural place, sometimes detached, but in that case sticking upright by accident. Preference is given to a good long stretch of smooth, even stalk, capable of accommodating the entire laying. My best harvests are made on the sprigs of *Spartium junceum,* which are like straws crammed with pith, and especially on the tall stalks of *Asphodelus cerasiferus,* which rise for nearly three feet before spreading into branches.

The rule is for the support, no matter what it is, to be dead and quite dry. Nevertheless my notes record a few instances of

[1] I have gathered the Cicada's eggs on *Spartium junceum,* or Spanish broom; on asphodel (*Asphodelus cerasiferus*); on Toad-flax (*Linaria striata*); on *Calamintha nepeta,* or lesser calamint; on *Hirschfeldia adpressa;* on *Chondrilla juncea,* or common gum-succory; on garlic (*Allium polyanthum*); on *Asteriscus spinosus* and other plants.—*Author's Note.*

eggs confided to stalks that are still alive, with green leaves and flowers in bloom. It is true that, in these highly exceptional cases, the stalk itself is of a pretty dry variety.[1]

The work performed by the Cicada consists of a series of pricks such as might be made with a pin if it were driven downwards on a slant and made to tear the ligneous fibres and force them up slightly. Any one seeing these dots without knowing what produced them would think first of some cryptogamous vegetation, some Sphæriacea swelling and bursting its skin under the growth of its half-emerging perithecia.

If the stalk be uneven, or if several Cicadæ have been working one after the other at the same spot, the distribution of the punctures becomes confused and the eye is apt to wander among them, unable to perceive either the order in which they were made or the work of each individual. One characteristic is never missing, that is the slanting direction of the woody strip ploughed up, which shows that the Cicada always works in an upright position and drives her imple-

[1] *Calamintha nepeta, Hirschfeldia adpressa.—Author's Note.*

ment downwards into the twig, in a longitudinal direction.

If the stalk be smooth and even and also of a suitable length, the punctures are nearly equidistant and are not far from being in a straight line. Their number varies: it is small when the mother is disturbed in her operation and goes off to continue her laying elsewhere; it amounts to thirty or forty when the line of dots represents the total amount of eggs laid. The actual length of the row for the same number of thrusts likewise varies. A few examples will enlighten us in this respect: a row of thirty measures 28 centimetres [1] on the toad-flax, 30 [2] on the gum-succory and only 12 [3] on the asphodel.

Do not imagine that these variations in length have to do with the nature of the support: there are plenty of instances that prove the contrary; and the asphodel, which in one case shows us the punctures that are closest together, will in other cases show us those which are farthest removed. The distance between the dots depends on circumstances which cannot be explained, but

[1] 10.9 inches.—*Translator's Note.*
[2] 11.7 inches.—*Translator's Note.*
[3] 4.6 inches.—*Translator's Note.*

especially on the caprice of the mother, who concentrates her laying more at one spot and less at another according to her fancy. I have found the average measurement between one hole and the next to be 8 to 10 millimetres.[1]

Each of these abrasions is the entrance to a slanting cell, usually bored in the pithy portion of the stalk. This entrance is not closed, save by the bunch of ligneous fibres which are parted at the time of the laying but which come together again when the double saw of the ovipositor is withdrawn. At most, in certain cases, but not always, you see gleaming through the threads of this barricade a tiny glistening speck, looking like a glaze of dried albumen. This can be only an insignificant trace of some albuminous secretion which accompanies the eggs or else facilitates the play of the double boring-file.

Just under the prick lies the cell, a very narrow passage which occupies almost the entire distance between its pin-hole and that of the preceding cell. Sometimes even there is no partition separating the two; the upper floor runs into the lower; and the eggs, though inserted through several entrances,

[1] .31 to .39 inch.—*Translator's Note.*

are arranged in an uninterrupted row. Usually, however, the cells are distinct.

Their contents vary greatly. I count from six to fifteen eggs in each. The average is ten. As the number of cells of a complete laying is between thirty and forty, we see that the Cicada disposes of three to four hundred eggs. Réaumur arrived at the same figures from his examination of the ovaries.

A fine family truly, capable by sheer numbers of coping with very grave risks of destruction. Yet I do not see that the adult Cicada is in greater danger than any other insect: he has a vigilant eye, can get started quickly, is a rapid flyer and inhabits heights at which the cut-throats of the meadows are not to be feared. The Sparrow, it is true, is very fond of him. From time to time, after careful strategy, the enemy swoops upon the plane-trees from the neighbouring roof and grabs the frenzied fiddler. A few pecks distributed right and left cut him up into quarters, which form delicious morsels for the nestlings. But how often does not the bird return with an empty bag! The wary Cicada sees the attack coming, empties his bladder into his assailant's eyes and decamps.

No, it is not the Sparrow that makes it necessary for the Cicada to give birth to so numerous a progeny. The danger lies elsewhere. We shall see how terrible it can be at hatching- and also at laying-time.

Two or three weeks after the emergence from the ground, that is to say, about the middle of July, the Cicada busies herself with her eggs. In order to witness the laying without trusting too much to luck, I had taken certain precautions which seemed to me to assure success. The insect's favourite support is the dry asphodel: I had learnt that from earlier observations. This plant is also the one that lends itself best to my plans, owing to its long, smooth stalk. Now, during the first years of my residence here, I replaced the thistles in my enclosure by other native plants, of a less forbidding character. The asphodel is among the new occupants and is just what I want to-day. I therefore leave last year's dry stalks where they are; and, when the proper season comes, I inspect them daily.

I have not long to wait. As early as the 15th of July, I find as many Cicadæ as I could wish installed on the asphodels, busily laying. The mother is always alone. Each

has a stalk to herself, without fear of any competition that might disturb the delicate process of inoculation. When the first occupant is gone, another may come, followed by others yet. There is ample room for all; but each in succession wishes to be alone. For the rest, there is no quarrelling among them; things happen most peacefully. If some mother appears and finds the place already taken, she flies away so soon as she discovers her mistake and looks around elsewhere.

The Cicada, when laying, always carries her head upwards, an attitude which, for that matter, she adopts in other circumstances. She lets you examine her quite closely, even under the magnifying-glass, so greatly absorbed is she in her task. The ovipositor, which is about two-fifths of an inch long, is buried in the stalk, slantwise. So perfect is the tool that the boring does not seem to call for very laborious operations. I see the mother give a jerk or two and dilate and contract the tip of her abdomen with frequent palpitations. That is all. The drill with its double gimlets working alternately digs and disappears into the wood, with a gentle and almost imperceptible movement.

Nothing particular happens during the laying. The insect is motionless. Ten minutes or so elapse between the first bite of the tool and the complete filling of the cell.

The ovipositor is then withdrawn with deliberate slowness, so as not to warp it. The boring-hole closes of itself, as the ligneous fibres come together again, and the insect climbs a little higher, about as far as the length of its instrument, in a straight line. Here we see a new punch of the gimlet and a new chamber receiving its half-a-score of eggs. In this fashion the laying works its way up from bottom to top.

Once we know these facts, we are in a position to understand the remarkable arrangement controlling the work. The punctures, the entrances to the cells, are almost equidistant, because each time the Cicada ascends about the same height, roughly the length of her ovipositor. Very rapid in flight, she is a very lazy walker. All that you ever see her do on the live branch on which she drinks is to move to a sunnier spot close by, with a grave and almost solemn step. On the dead branch where the eggs are laid she retains her leisurely habits, even exaggerating them, in view of the importance of

the operation. She moves as little as need be, shifting her place only just enough to avoid letting two adjoining cells encroach upon each other. The measure of the upward movement is provided approximately by the length of the bore.

Also the holes are arranged in a straight line when their number is not great. Why indeed should the laying mother veer to the left or right on a stalk which has the same qualities all over? Loving the sun, she has selected the side of the stalk that is most exposed to it. So long as she feels on her back a douche of heat, her supreme joy, she will take good care not to leave the situation which she considers so delightful for another upon which the sun's rays do not fall so directly.

But the laying takes a long time when it is all performed on the same support. Allowing ten minutes to a cell, the series of forty which I have sometimes seen represents a period of six to seven hours. The sun therefore can alter its position considerably before the Cicada has finished her work. In that case the rectilinear direction becomes bent into a spiral curve. The mother turns around her stalk as the sun itself turns; and

her row of pricks suggests the course of the gnomon's shadow on a cylindrical sundial.

Very often, while the Cicada is absorbed in her work of motherhood, an infinitesimal Gnat, herself the bearer of a boring-tool, labours to exterminate the eggs as fast as they are placed. Réaumur knew her. In nearly every bit of stick that he examined he found her grub, which caused him to make a mistake at the beginning of his researches. But he did not see, he could not see the impudent ravager at work. It is a Chalcidid some four to five millimetres [1] in length, all black, with knotty antennæ, thickening a little towards their tips. The unsheathed boring-tool is planted in the under part of the abdomen, near the middle, and sticks out at right angles to the body, as in the case of the Leucospes,[2] the scourge of certain members of the Bee-tribe. Having neglected to capture the insect, I do not know what name the nomenclators have bestowed upon it, if indeed the dwarf that exterminates Cicadæ has been catalogued at all.

What I do know something about is its

[1] .156 to .195 inch.—*Translator's Note.*

[2] Cf. *The Mason-bees,* by J. Henri Fabre, translated by Alexander Teixeira de Mattos: chap. xi.—*Translator's Note.*

calm temerity, its brazen audacity in the immediate presence of the colossus who could crush it by simply stepping on it. I have seen as many as three exploiting the unhappy mother at the same time. They keep close behind each other, either working their probes or awaiting the propitious moment.

The Cicada has just stocked a cell and is climbing a little higher to bore the next. One of the brigands runs to the abandoned spot; and here, almost under the claws of the giantess, without the least fear, as though she were at home and accomplishing a meritorious act, she unsheathes her probe and inserts it into the column of eggs, not through the hole already made, which bristles with broken fibres, but through some lateral crevice. The tool works slowly, because of the resistance of the wood, which is almost intact. The Cicada has time to stock the next floor above.

As soon as she has finished, a Gnat standing immediately behind her, waiting to perform her task, takes her place and comes and introduces her own exterminating germ. By the time that the mother has exhausted her ovaries and flies away, most of her cells have, in this fashion, received the alien egg which

will be the ruin of their contents. A small, quick-hatching grub, one only to each chamber, generously fed on a round dozen raw eggs, will take the place of the Cicada's family.

O deplorable mother, have centuries of experience taught you nothing? Surely, with those excellent eyes of yours, you cannot fail to see the terrible sappers, when they flutter around you, preparing their felon stroke! You see them, you know that they are at your heels; and you remain impassive and let yourself be victimized. Turn round, you easy-going colossus, and crush the pigmies! But you will do nothing of the sort: you are incapable of altering your instincts, even to lighten your share of maternal sorrow.

The Common Cicada's eggs are of a gleaming ivory-white. Elongated in shape and conical at both ends, they might be compared with miniature weavers'-shuttles. They are two millimetres and a half long by half a millimetre wide.[1] They are arranged in a row, slightly overlapping. The Ash Cicada's, which are a trifle smaller, are packed in regular parcels mimicking microscopic bundles of cigars. We will devote

[1] About $\frac{1}{10}$ x $\frac{1}{20}$ inch.—*Translator's Note.*

our attention exclusively to the first; their story will tell us that of the others.

September is not over before the gleaming ivory-white gives place to straw-colour. In the early days of October there appear, in the front part, two little dark-brown spots, round and clearly-defined, which are the ocular specks of the tiny creature in course of formation. These two shining eyes, which almost look at you, combined with the cone-shaped fore-end, give the eggs an appearance of finless fishes, the very tiniest of fishes, for which a walnut-shell would make a suitable bowl.

About the same period, I often see on my asphodels and those on the hills around indications of a recent hatching. These indications take the form of certain discarded clothes, certain rags left on the threshold by the new-born grubs moving their quarters and eager to reach a new lodging. We shall learn in an instant what these cast skins mean.

Nevertheless, in spite of my visits, which were assiduous enough to deserve a better result, I have never succeeded in seeing the young Cicadæ come out of their cells. My home breeding prospers no better. For two

years running, at the right time, I collect in boxes, tubes and jars a hundred twigs of all sorts colonized with Cicada-eggs; not one of them shows me what I am so anxious to see, the emergence of the budding Cicadæ.

Réaumur experienced the same disappointment. He tells us how all the eggs sent by his friends proved failures, even when he carried them in a glass tube in his fob to give them a mild temperature. O my revered master, neither the warm shelter of our studies nor the niggardly heating-apparatus of our breeches is enough in this case! What is needed is that supreme stimulant, the kisses of the sun; what is needed, after the morning coolness, which already is sharp enough to make us shiver, is the sudden glow of a glorious autumn day, summer's last farewell.

It was in such circumstances as these, when a bright sun supplied a violent contrast to a cold night, that I used to find signs of hatching; but I always came too late: the young Cicadæ were gone. At most I sometimes happened to find one hanging by a thread from his native stalk and struggling in mid-air. I thought him caught in some shred of cobweb.

At last, on the 27th of October, despairing of success, I gathered the asphodels in the enclosure and, taking the armful of dry stalks on which the Cicada had laid, carried it up to my study. Before abandoning all hope, I proposed once more to examine the cells and their contents. It was a cold morning. The first fire of the season had been lit. I put my little bundle on a chair in front the hearth, without any intention of trying the effect of the hot flames upon the nests. The sticks which I meant to split open one by one were within easier reach of my hand there. That was the only consideration which made me choose that particular spot.

Well, while I was passing my magnifying-glass over a split stem, the hatching which I no longer hoped to see suddenly took place beside me. My bundle became alive; the young larvæ emerged from their cells by the dozen. Their number was so great that my professional instincts were amply satisfied. The eggs were exactly ripe; and the blaze on the hearth, bright and penetrating, produced the same effect as sunlight out of doors. I lost no time in profiting by this unexpected stroke of luck.

At the aperture of the egg-chamber, among the torn fibres, a tiny cone-shaped body appears, with two large black eye-spots. To look at, it is absolutely the fore-part of the egg, which, as I have said, resembles the front of a very minute fish. One would think that the egg had changed its position, climbing from the bottom of the basin to the orifice of the little passage. But an egg to move! A germ to start walking! Such a thing was impossible, had never been known; I must be suffering from an illusion. I split open the stalk; and the mystery is revealed. The real eggs, though a little disarranged, have not changed their position. They are empty, reduced to transparent bags, torn considerably at their fore-ends. From them has issued the very singular organism whose salient characteristics I will now set forth.

In its general shape, the configuration of the head and the large black eyes, the creature, even more than the egg, presents the appearance of an extremely small fish. A mock ventral fin accentuates the likeness. This sort of oar comes from the fore-legs, which, cased in a special sheath, lie backwards, stretched against each other in a

straight line. Its feeble power of movement must help the grub to come out of the egg-shell and—a more difficult matter—out of the fibrous passage. Withdrawing a little way from the body and then returning, this lever provides a purchase for progression by means of the terminal claws, which are already well-developed. The four other legs are still wrapped in the common envelope and are absolutely inert. This applies also to the antennæ, which can hardly be perceived through the lens. Altogether, the organism newly issued from the egg is an exceedingly small, boat-shaped body, with a single oar pointing backwards on the ventral surface and formed of the two fore-legs joined together. The segmentation is very clearly marked, especially on the abdomen. Lastly, the whole thing is quite smooth, with not a hair on it.

What name shall I give to this initial state of the Cicada, a state so strange and unforeseen and hitherto unsuspected? Must I knock Greek words together and fashion some uncouth expression? I shall do nothing of the sort, convinced as I am that barbarous terms are only a cumbrous impediment to science. I shall simply call it " the primary

larva," as I did in the case of the Oil-beetles, the Leucospes and the Anthrax.[1]

The form of the primary larva in the Cicadæ is eminently well-suited for the emergence. The passage in which the egg is hatched is very narrow and leaves just room for one to go out. Besides, the eggs are arranged in a row, not end to end, but partly overlapping. The creature coming from the farther ranks has to make its way through the remains of the eggs already hatched in front of it. To the narrowness of the corridor is added the block caused by the empty shells.

In these conditions, the larva in the form which it will have presently, when it has torn its temporary scabbard, would not be able to clear the difficult pass. Irksome antennæ, long legs spreading far from the axis of the body, picks with curved and pointed ends that catch on the road: all these are in the way of a speedy deliverance. The eggs in one cell hatch almost simultaneously. It is necessary that the new-born grubs in front should move out as fast as they can and make

[1] Cf. *The Life of the Fly*, by J. Henri Fabre, translated by Alexander Teixeira de Mattos: chaps. ii, iii and v.—*Translator's Note.*

room for those behind. This necessitates the smooth, boatlike form, devoid of all projections, which makes its way insinuatingly, like a wedge. The primary larva, with its different appendages closely fixed to its body inside a common sheath, with its boat shape and its single oar possessing a certain power of movement, has its part to play: its business is to emerge into daylight through a difficult passage.

Its task is soon done. Here comes one of the emigrants, showing its head with the great eyes and lifting the broken fibres of the aperture. It works its way farther and farther out, with a progressive movement so slow that the lens does not easily perceive it. In half an hour at soonest, the boat-shaped object appears entirely; but it is still caught by its hinder end in the exit-hole.

The emergence-jacket splits without further delay; and the creature sheds its skin from front to back. It is now the normal larva, the only one that Réaumur knew. The cast slough forms a suspensory thread, expanding into a little cup at its free end. In this cup is contained the tip of the abdomen of the larva, which, before dropping to the ground, treats itself to a sun-bath, hardens

itself, kicks about and tries its strength, swinging indolently at the end of its life-line.

This "little Flea," as Réaumur calls it, first white, then amber, is at all points the larva that will dig into the ground. The antennæ, of fair length, are free and wave about; the legs work their joints; those in front open and shut their claws, which are the strongest part of them. I know hardly any more curious sight than that of this miniature gymnast hanging by its hinder-part, swinging at the least breath of wind and making ready in the air for its somersault into the world. The period of suspension varies. Some larvæ let themselves drop in half an hour or so; others remain for hours in their long-stemmed cup; and some even wait until the next day.

Whether quick or slow, the creature's fall leaves the cord, the slough of the primary larva, swinging. When the whole brood has disappeared, the orifice of the cell is thus hung with a cluster of short, fine threads, twisted and rumpled, like dried white of egg. Each opens into a little cup at its free end. They are very delicate and ephemeral relics, which you cannot touch without de-

stroying them. The slightest wind soon blows them away.

Let us return to the larva. Sooner or later, without losing much time, it drops to the ground, either by accident or of its own accord. The infinitesimal creature, no bigger than a Flea, has saved its tender, budding flesh from the rough earth by swinging on its cord. It has hardened itself in the air, that luxurious eiderdown. It now plunges into the stern realities of life.

I see a thousand dangers ahead of it. The merest breath of wind can blow the atom here, on the impenetrable rock, or there, on the ocean of a rut where a little water stagnates, or elsewhere, on the sand, the starvation region where nothing grows, or again on a clay soil, too tough for digging. These fatal expanses are frequent; and so are the gusts that blow one away in this windy season which has already set in unpleasantly by the end of October.

The feeble creature needs very soft soil, easily entered, so as to obtain shelter immediately. The cold days are drawing nigh; the frosts are coming. To wander about on the surface of the ground for any length of time would expose us to grave dangers. We

had better descend into the earth without delay; and that to a good depth. This one imperative condition of safety is in many cases impossible to realize. What can little Flea's-claws do against rock, flint or hardened clay? The tiny creature must perish unless it can find an underground refuge in time.

The first establishment, which is exposed to so many evil chances, is, so everything shows us, a cause of great mortality in the Cicada's family. Already the little black parasite, the destroyer of the eggs, has told us how expedient it is for the mothers to accomplish a long and fertile laying; the difficulties attendant upon the initial installation in their turn explain why the maintenance of the race at its suitable strength requires three or four hundred eggs to be laid by each of them. Subject to excessive spoliation, the Cicada is fertile to excess. She averts by the richness of her ovaries the multitude of dangers threatening her.

In the experiment which it remains for me to make, I will at least spare the larva the difficulties of the first installation. I select some very soft, very black heath-mould and pass it through a fine sieve. Its dark

colour will enable me more easily to find the little yellow creature when I want to see what is happening; and its softness will suit the feeble mattock. I heap it not too tightly in a glass pot; I plant a little tuft of thyme in it; I sow a few grains of wheat. There is no hole at the bottom of the pot, though there ought to be, if the thyme and the wheat are to thrive; the captives, however, finding the hole, would be certain to escape through it. The plantation will suffer from this lack of drainage; but at least I am certain of finding my animals with the aid of my magnifying-glass and plenty of patience. Besides, I shall indulge in no excesses in the matter of irrigation, supplying only enough water to prevent the plants from dying.

When everything is ready and the corn is beginning to put forth its first shoots, I place six young Cicada-larvæ on the surface of the soil. The puny grubs run about and explore the earthy bed pretty nimbly; some make unsuccessful attempts to climb the side of the pot. Not one seems inclined to bury itself, so much so that I anxiously wonder what the object can be of these active and prolonged investigations. Two hours pass and the restless roaming never ceases.

What is it that they want? Food? I offer them some little bulbs with bundles of sprouting roots, a few bits of leaves and some fresh blades of grass. Nothing tempts them nor induces them to stand still. They appear to be selecting a favourable spot before descending underground. These hesitating explorations are superfluous on the soil which I have industriously prepared for them: the whole surface, so it seems to me, lends itself capitally to the work which I expect to see them accomplish. Apparently it is not enough.

Under natural conditions, a preliminary run round may well be indispensable. There, sites as soft as my bed of heath-mould, purged of all hard bodies and finely sifted, are rare. There, on the other hand, coarse soils, on which the microscopic mattock can make no impression, are frequent. The grub has to roam at random, to walk about for some time before finding a suitable place. No doubt many even die, exhausted by their fruitless search. A journey of exploration, in a country a few inches across, forms part, therefore, of the young Cicada's curriculum. In my glass jar, so sumptuously furnished, the pilgrimage is uncalled for. No matter:

it has to be performed according to the time-honoured rites.

My gadabouts at last grow calm. I see them attack the earth with the hooked mattocks of their fore-feet, digging into it and making the sort of excavation which the point of a thick needle would produce. Armed with a magnifying-glass, I watch them wielding their pick-axes, watch them raking an atom of earth to the surface. In a few minutes a well has been scooped out. The little creature goes down it, buries itself and is henceforth invisible.

Next day I turn out the contents of the pot, without breaking the clod held together by the roots of the thyme and the wheat. I find all my larvæ at the bottom, stopped from going farther by the glass. In twenty-four hours they have traversed the entire thickness of the layer of earth, about four inches. They would have gone even lower but for the obstacle at the bottom.

On their way they probably came across my thyme- and wheat-roots. Did they stop to take a little nourishment by driving in their suckers? It is hardly probable. A few of these rootlets are trailing at the bottom of the empty pot. Not one of my

six prisoners is installed on them. Perhaps in overturning the glass I have shaken them off.

It is clear that underground there can be no other food for them than the juice of the roots. Whether full-grown or in the larval stage, the Cicada lives on vegetables. As an adult, he drinks the sap of the branches; as a larva, he sucks the sap of the roots. But at what moment is the first sip taken? This I do not yet know. What goes before seems to tell us that the newly-hatched grub is in a greater hurry to reach the depths of the soil, sheltered from the coming colds of winter, than to loiter at the drinking-bars encountered on the way.

I put back the clod of heath-mould and for the second time place the six exhumed larvæ on the surface of the soil. Wells are dug without delay. The grubs disappear down them. Finally I put the pot in my study-window, where it will receive all the influences of the outer air, good and bad alike.

A month later, at the end of November, I make a second inspection. The young Cicadæ are crouching, each by itself, at the bottom of the clod of earth. They are not

clinging to the roots; they have not altered in appearance or in size. I find them now just as I saw them at the beginning of the experiment, only a little less active. Does not this absence of growth during the interval of November, the mildest month of winter, seem to show that no nourishment is taken throughout the cold season?

The young Sitaris-beetles,[1] those other animated atoms, as soon as they issue from the egg at the entrance to the Anthophora's [2] galleries, remain in motionless heaps and spend the winter in complete abstinence. The little Cicadæ would appear to behave in much the same manner. Once buried in depths where there is no fear of frosts, they sleep, solitary, in their winter-quarters and await the return of spring before broaching some root near by and taking their first refreshment.

I have tried, but without success, to confirm by actual observation the inferences to be drawn from the above results. In the spring, in April, for the third time I unpot my plantation. I break up the clod and

[1] Cf. *The Life of the Fly:* chap. iv.—*Translator's Note.*
[2] Cf. *Bramble-bees and Others,* by J. Henri Fabre, translated by Alexander Teixeira de Mattos: *passim.*—*Translator's Note.*

scrutinize it under the magnifying-glass. I feel as if I were looking for a needle in a haystack. At last I find my little Cicadæ. They are dead, perhaps of cold, notwithstanding the bell-glass with which I had covered the pot; perhaps of starvation, if the thyme did not suit them. The problem is too difficult to solve; I give it up.

To succeed in this attempt at rearing one would need a very wide and deep bed of earth, providing a shelter from the rigours of winter, and, because I do not know which are the insect's favourite roots, there would also have to be a varied vegetation, in which the little larvæ could choose according to their tastes. These conditions are quite practicable; but how is one afterwards to find in that huge mass of earth, measuring a cubic yard at least, the atom which I have so much trouble in distinguishing in a handful of black mould? And, besides, such conscientious digging would certainly detach the tiny creature from the root that nourishes it.

The underground life of the early Cicada remains a secret. That of the well-developed larva is no better-known. When digging in the fields, if you turn up the soil to any depth, you are constantly finding the fierce

little burrower under your spade; but to find it fastened to the roots from whose sap it undoubtedly derives its nourishment is quite another matter. The upheaval occasioned by the spade warns it of its danger. It releases its sucker and retreats to some gallery; and, when discovered, it is no longer drinking.

If agricultural digging, with its inevitable disturbances, is unable to tell us anything of the grub's underground habits, it does at least inform us how long the larval stage lasts. Some obliging husbandmen, breaking up their land, in March, rather deeper than usual, were so very good as to pick up for me all the larvæ, big and small, unearthed by their labour. The harvest amounted to several hundreds. Marked differences in bulk divided the total into three classes: the large ones, with rudiments of wings similar to those possessed by the larvæ leaving the ground, the medium-sized and the small. Each of these classes must correspond with a different age. We will add to them the larvæ of the last hatching, microscopic creatures that necessarily escaped the eyes of my rustic collaborators; and we arrive at four years as the probable duration of the underground life of the Cicadæ.

Their existence in the air is more easily calculated. I hear the first Cicadæ at the approach of the summer solstice. The orchestra attains its full strength a month later. A few laggards, very few and very far between, continue to execute their faint solos until the middle of September. That is the end of the concert. As they do not all come out of the ground at the same period, it is obvious that the singers of September are not contemporary with those of June. If we strike an average between these two extreme dates, we shall have about five weeks.

Four years of hard work underground and a month of revelry in the sun: this then represents the Cicada's life. Let us no longer blame the adult for his delirious triumph. For four years, in the darkness, he has worn a dirty parchment smock; for four years he has dug the earth with his mattocks; and behold the mud-stained navvy suddenly attired in exquisite raiment, possessed of wings that rival the bird's, drunk with the heat and inundated with light, the supreme joy of this world! What cymbals could ever be loud enough to celebrate such felicity, so richly earned and so ephemeral!

CHAPTER VI

THE MANTIS: HER HUNTING

ANOTHER creature of the south, at least as interesting as the Cicada, but much less famous, because it makes no noise. Had Heaven granted it a pair of cymbals, the one thing needed, its renown would eclipse the great musician's, for it is most unusual in both shape and habits. Folk hereabouts call it *lou Prègo-Diéu,* the animal that prays to God. Its official name is the Praying Mantis (*M. religiosa,* LIN.).

The language of science and the peasant's artless vocabulary agree in this case and represent the queer creature as a pythoness delivering her oracles or an ascetic rapt in pious ecstasy. The comparison dates a long way back. Even in the time of the Greeks the insect was called *Μάντις,* the divine, the prophet. The tiller of the soil is not particular about analogies: where points of resemblance are not too clear, he will make

up for their deficiencies. He saw on the sun-scorched herbage an insect of imposing appearance, drawn up majestically in a half-erect posture. He noticed its gossamer wings, broad and green, trailing like long veils of finest lawn; he saw its fore-legs, its arms so to speak, raised to the sky in a gesture of invocation. That was enough; popular imagination did the rest; and behold the bushes from ancient times stocked with Delphic priestesses, with nuns in orison.

Good people, with your childish simplicity, how great was your mistake! Those sanctimonious airs are a mask for Satanic habits; those arms folded in prayer are cut-throat weapons: they tell no beads, they slay whatever passes within range. Forming an exception which one would never have suspected in the herbivorous order of the Orthoptera, the Mantis feeds exclusively on living prey. She is the tigress of the peaceable entomological tribes, the ogress in ambush who levies a tribute of fresh meat. Picture her with sufficient strength; and her carnivorous appetites, combined with her traps of horrible perfection, would make her the terror of the country-side. The *Prègo-Diéu* would become a devilish vampire.

The Mantis: her Hunting

Apart from her lethal implement, the Mantis has nothing to inspire dread. She is not without a certain beauty, in fact, with her slender figure, her elegant bust, her pale-green colouring and her long gauze wings. No ferocious mandibles, opening like shears; on the contrary, a dainty pointed muzzle that seems made for billing and cooing. Thanks to a flexible neck, quite independent of the thorax, the head is able to move freely, to turn to right or left, to bend, to lift itself. Alone among insects, the Mantis directs her gaze; she inspects and examines; she almost has a physiognomy.

Great indeed is the contrast between the body as a whole, with its very pacific aspect, and the murderous mechanism of the fore-legs, which are correctly described as raptorial. The haunch is uncommonly long and powerful. Its function is to throw forward the rat-trap, which does not await its victim but goes in search of it. The snare is decked out with some show of finery. The base of the haunch is adorned on the inner surface with a pretty, black mark, having a white spot in the middle; and a few rows of bead-like dots complete the ornamentation.

The thigh, longer still, a sort of flat-

tened spindle, carries on the front half of its lower surface two rows of sharp spikes. In the inner row there are a dozen, alternately black and green, the green being shorter than the black. This alternation of unequal lengths increases the number of cogs and improves the effectiveness of the weapon. The outer row is simpler and has only four teeth. Lastly, three spurs, the longest of all, stand out behind the two rows. In short, the thigh is a saw with two parallel blades, separated by a groove in which the leg lies when folded back.

The leg, which moves very easily on its joint with the thigh, is likewise a double-edged saw. The teeth are smaller, more numerous and closer together than those on the thigh. It ends in a strong hook whose point vies with the finest needle for sharpness, a hook fluted underneath and having a double blade like a curved pruning-knife.

This hook, a most perfect instrument for piercing and tearing, has left me many a painful memory. How often, when Mantis-hunting, clawed by the insect which I had just caught and not having both hands at liberty, have I been obliged to ask somebody else to release me from my tenacious cap-

tive! To try to free yourself by force, without first disengaging the claws implanted in your flesh, would expose you to scratches similar to those produced by the thorns of a rose-tree. None of our insects is so troublesome to handle. The Mantis claws you with her pruning-hooks, pricks you with her spikes, seizes you in her vice and makes self-defence almost impossible if, wishing to keep your prize alive, you refrain from giving the pinch of the thumb that would put an end to the struggle by crushing the creature.

When at rest, the trap is folded and pressed back against the chest and looks quite harmless. There you have the insect praying. But, should a victim pass, the attitude of prayer is dropped abruptly. Suddenly unfolded, the three long sections of the machine throw to a distance their terminal grapnel, which harpoons the prey and, in returning, draws it back between the two saws. The vice closes with a movement like that of the fore-arm and the upper arm; and all is over: Locusts, Grasshoppers and others even more powerful, once caught in the mechanism with its four rows of teeth, are irretrievably lost. Neither their desperate

fluttering nor their kicking will make the terrible engine release its hold.

An uninterrupted study of the Mantis' habits is not practicable in the open fields; we must rear her at home. There is no difficulty about this: she does not mind being interned under glass, on condition that she be well fed. Offer her choice viands, served up fresh daily, and she will hardly feel her absence from the bushes.

As cages for my captives I have some ten large wire-gauze dish-covers, the same that are used to protect meat from the Flies. Each stands in a pan filled with sand. A dry tuft of thyme and a flat stone on which the laying may be done later constitute all the furniture. These huts are placed in a row on the large table in my insect laboratory, where the sun shines on them for the best part of the day. I instal my captives in them, some singly, some in groups.

It is in the second fortnight of August that I begin to come upon the adult Mantis in the withered grass and on the brambles by the road-side. The females, already notably corpulent, are more frequent from day to day. Their slender companions, on the other hand, are rather scarce; and I some-

times have a good deal of difficulty in making up my couples, for there is an appalling consumption of these dwarfs in the cages. Let us keep these atrocities for later and speak first of the females.

They are great eaters, whose maintenance, when it has to last for some months, is none too easy. The provisions, which are nibbled at disdainfully and nearly all wasted, have to be renewed almost every day. I trust that the Mantis is more economical on her native bushes. When game is not plentiful, no doubt she devours every atom of her catch; in my cages she is extravagant, often dropping and abandoning the rich morsel after a few mouthfuls, without deriving any further benefit from it. This appears to be her particular method of beguiling the tedium of captivity.

To cope with these extravagant ways I have to employ assistants. Two or three small local idlers, bribed by the promise of a slice of melon or bread-and-butter, go morning and evening to the grass-plots in the neighbourhood and fill their game-bags —cases made of reed-stumps—with live Locusts and Grasshoppers. I on my side, net in hand, make a daily circuit of my enclosure,

in the hope of obtaining some choice morsel for my boarders.

These tit-bits are intended to show me to what lengths the Mantis' strength and daring can go. They include the big Grey Locust (*Pachytylus cinerescens,* FAB.), who is larger than the insect that will consume him; the White-faced Decticus, armed with a vigorous pair of mandibles whereof our fingers would do well to fight shy; the quaint Tryxalis, who wears a pyramid-shaped mitre on her head; the Vine Ephippiger,[1] who clashes cymbals and sports a sword at the bottom of her pot-belly. To this assortment of game that is not any too easy to tackle, let us add two monsters, two of the largest Spiders of the district: the Silky Epeira, whose flat, festooned abdomen is the size of a franc piece; and the Cross Spider, or Diadem Epeira,[2] who is hideously hairy and obese.

I cannot doubt that the Mantis attacks such adversaries in the open, when I see her,

[1] The Decticus, Tryxalis and Ephippiger are all species of Grasshoppers or Locusts.—*Translator's Note.*

[2] *Epeira sericea* and *E. diadema* are two Garden Spiders for whom cf. *The Life of the Spider,* by J. Henri Fabre, translated by Alexander Teixeira de Mattos: chaps. ix to xiv.—*Translator's Note.*

under my covers, boldly giving battle to whatever comes in sight. Lying in wait among the bushes, she must profit by the fat prizes offered by chance even as, in the wire cage, she profits by the treasures due to my generosity. Those big hunts, full of danger, are no new thing; they form part of her normal existence. Nevertheless they appear to be rare, for want of opportunity, perhaps to the Mantis' deep regret.

Locusts of all kinds, Butterflies, Dragonflies, large Flies, Bees and other moderate-sized captures are what we usually find in the lethal limbs. Still the fact remains that, in my cages, the daring huntress recoils before nothing. Sooner or later, Grey Locust and Decticus, Epeira and Tryxalis are harpooned, held tight between the saws and crunched with gusto. The facts are worth describing.

At the sight of the Grey Locust who has heedlessly approached along the trelliswork of the cover, the Mantis gives a convulsive shiver and suddenly adopts a terrifying posture. An electric shock would not produce a more rapid effect. The transition is so abrupt, the attitude so threatening that the observer beholding it for the first time at

once hesitates and draws back his fingers, apprehensive of some unknown danger. Old hand as I am, I cannot even now help being startled, should I happen to be thinking of something else.

You see before you, most unexpectedly, a sort of bogey-man or Jack-in-the-box. The wing-covers open and are turned back on either side, slantingly; the wings spread to their full extent and stand erect like parallel sails or like a huge heraldic crest towering over the back; the tip of the abdomen curls upwards like a crosier, rises and falls, relaxing with short jerks and a sort of sough, a "Whoof! Whoof!" like that of a Turkey-cock spreading his tail. It reminds one of the puffing of a startled Adder.

Planted defiantly on its four hind-legs, the insect holds its long bust almost upright. The murderous legs, originally folded and pressed together upon the chest, open wide, forming a cross with the body and revealing the arm-pits decorated with rows of beads and a black spot with a white dot in the centre. These two faint imitations of the eyes in a Peacock's tail, together with the dainty ivory beads, are warlike ornaments kept hidden at ordinary times. They are

taken from the jewel-case only at the moment when we have to make ourselves brave and terrible for battle.

Motionless in her strange posture, the Mantis watches the Locust, with her eyes fixed in his direction and her head turning as on a pivot whenever the other changes his place. The object of this attitudinizing is evident: the Mantis wants to strike terror into her dangerous quarry, to paralyze it with fright, for, unless demoralized by fear, it would prove too formidable.

Does she succeed in this? Under the shiny head of the Decticus, behind the long face of the Locust, who can tell what passes? No sign of excitement betrays itself to our eyes on those impassive masks. Nevertheless it is certain that the threatened one is aware of the danger. He sees standing before him a spectre, with uplifted claws, ready to fall upon him; he feels that he is face to face with death; and he fails to escape while there is yet time. He who excels in leaping and could so easily hop out of reach of those talons, he, the big-thighed jumper, remains stupidly where he is, or even draws nearer with a leisurely step.

They say that little birds, paralysed with

terror before the open jaws of the Snake, spell-bound by the reptile's gaze, lose their power of flight and allow themselves to be snapped up. The Locust often behaves in much the same way. See him within reach of the enchantress. The two grapnels fall, the claws strike, the double saws close and clutch. In vain the poor wretch protests: he chews space with his mandibles and, kicking desperately, strikes nothing but the air. His fate is sealed. The Mantis furls her wings, her battle-standard; she resumes her normal posture; and the meal begins.

In attacking the Tryxalis and the Ephippiger, less dangerous game than the Grey Locust and the Decticus, the spectral attitude is less imposing and of shorter duration. Often the throw of the grapnels is sufficient. This is likewise so in the case of the Epeira, who is grasped round the body with not a thought of her poison-fangs. With the smaller Locusts, the usual fare in my cages as in the open fields, the Mantis seldom employs her intimidation-methods and contents herself with seizing the reckless one that passes within her reach.

When the prey to be captured is able to offer serious resistance, the Mantis has at

her service a pose that terrorizes and fascinates her quarry and gives her claws a means of hitting with certainty. Her rat-traps close on a demoralized victim incapable of defence. She frightens her victim into immobility by suddenly striking a spectral attitude.

The wings play a great part in this fantastic pose. They are very wide, green on the outer edge, colourless and transparent every elsewhere. They are crossed lengthwise by numerous veins, which spread in the shape of a fan. Other veins, transversal and finer, intersect the first at right angles and with them form a multitude of meshes. In the spectral attitude, the wings are displayed and stand upright in two parallel planes that almost touch each other, like the wings of a Butterfly at rest. Between them the curled tip of the abdomen moves with sudden starts. The sort of breath which I have compared with the puffing of an Adder in a posture of defence comes from this rubbing of the abdomen against the nerves of the wings. To imitate the strange sound, all that you need do is to pass your nail quickly over the upper surface of an unfurled wing.

Wings are essential to the male, a slender

pigmy who has to wander from thicket to thicket at mating-time. He has a well-developed pair, more than sufficient for his flight, the greatest range of which hardly amounts to four or five of our paces. The little fellow is exceedingly sober in his appetites. On rare occasions, in my cages, I catch him eating a lean Locust, an insignificant, perfectly harmless creature. This means that he knows nothing of the spectral attitude, which is of no use to an unambitious hunter of his kind.

On the other hand, the advantage of the wings to the female is not very obvious, for she is inordinately stout at the time when her eggs ripen. She climbs, she runs; but, weighed down by her corpulence, she never flies. Then what is the object of wings, of wings, too, which are seldom matched for breadth?

The question becomes more significant if we consider the Grey Mantis (*Ameles decolor*), who is closely akin to the Praying Mantis. The male is winged and is even pretty quick at flying. The female, who drags a great belly full of eggs, reduces her wings to stumps and, like the cheese-makers of Auvergne and Savoy, wears a short-tailed

jacket. For one who is not meant to leave the dry grass and the stones, this abbreviated costume is more suitable than superfluous gauze furbelows. The Grey Mantis is right to retain but a mere vestige of the cumbrous sails.

Is the other wrong to keep her wings, to exaggerate them, even though she never flies? Not at all. The Praying Mantis hunts big game. Sometimes a formidable prey appears in her hiding-place. A direct attack might be fatal. The thing to do is first to intimidate the new-comer, to conquer his resistance by terror. With this object she suddenly unfurls her wings into a ghost's winding-sheet. The huge sails incapable of flight are hunting-implements. This stratagem is not needed by the little Grey Mantis, who captures feeble prey, such as Gnats and new-born Locusts. The two huntresses, who have similar habits and, because of their stoutness, are neither of them able to fly, are dressed to suit the difficulties of the ambuscade. The first, an impetuous amazon, puffs her wings into a threatening standard; the second, a modest fowler, reduces them to a pair of scanty coat-tails.

In a fit of hunger, after a fast of some

days' duration, the Praying Mantis will gobble up a Grey Locust whole, except for the wings, which are too dry; and yet the victim of her voracity is as big as herself, or even bigger. Two hours are enough for consuming this monstrous head of game. An orgy of the sort is rare. I have witnessed it once or twice and have always wondered how the gluttonous creature found room for so much food and how it reversed in its favour the axiom that the cask must be greater than its contents. I can but admire the lofty privileges of a stomach through which matter merely passes, being at once digested, dissolved and done away with.

The usual bill of fare in my cages consists of Locusts of greatly varied species and sizes. It is interesting to watch the Mantis nibbling her Acridian, firmly held in the grip of her two murderous fore-legs. Notwithstanding the fine, pointed muzzle, which seems scarcely made for this gorging, the whole dish disappears, with the exception of the wings, of which only the slightly fleshy base is consumed. The legs, the tough skin, everything goes down. Sometimes the Mantis seizes one of the big hinder thighs by the knuckle-end, lifts it to her mouth,

tastes it and crunches it with a little air of satisfaction. The Locust's fat and juicy thigh may well be a choice morsel for her, even as a leg of mutton is for us.

The prey is first attacked in the neck. While one of the two lethal legs holds the victim transfixed through the middle of the body, the other presses the head and makes the neck open upwards. The Mantis' muzzle roots and nibbles at this weak point in the armour with some persistency. A large wound appears in the head. The Locust gradually ceases kicking and becomes a lifeless corpse; and, from this moment, freer in its movements, the carnivorous insect picks and chooses its morsel.

This preliminary gnawing of the neck is too regular an occurrence to be purposeless. Let us indulge in a digression which will tell us more about it. In June I often find on the lavender in the enclosure two small Crab Spiders (*Thomisus onustus,* WALCK.,[1] and *T. rotundatus,* WALCK.). One is satin-white and has pink and green rings round her legs; the other is inky-black and has an abdomen encircled with red with a foliaceous

[1] Cf. *The Life of the Spider:* chap. viii.—*Translator's Note.*

central patch. They are pretty Spiders, both of them, and they walk sideways, after the manner of Crabs. They do not know how to weave a hunting-net; the little silk which they possess is reserved exclusively for the downy satchel containing the eggs. Their plan of campaign therefore is to lie in ambush on the flowers and to fling themselves unexpectedly on the quarry when it arrives on pilfering intent.

Their favourite prey is the Hive-bee. I often come upon them with their prize, at times grabbed by the neck and at others by any part of the body, even the tip of a wing. In each and every case the Bee is dead, with her legs hanging limply and her tongue out.

The poison-fangs planted in the neck set me thinking; I see in them a characteristic remarkably like the practice of the Mantis when starting on her Locust. And then arises another question: how does the weak Spider, who is vulnerable in every part of her soft body, manage to get hold of a prey like the Bee, stronger than herself, quicker in movement and armed with a sting that can inflict a mortal wound?

The difference in physical strength and force of arms between assailant and assailed

is so very great that a contest of this kind seems impossible unless some netting intervene, some silken toils that can shackle and bind the formidable creature. The contrast would be no more intense were the Sheep to take it into her head to fly at the Wolf's throat. And yet the daring attack takes place and victory goes to the weaker, as is proved by the numbers of dead Bees whom I see sucked for hours by the Thomisi. The relative weakness must be made good by some special art; the Spider must possess a strategy that enables her to surmount the apparently insurmountable difficulty.

To watch events on the lavender-borders would expose me to long, fruitless waits. It is better myself to make the preparations for the duel. I place a Thomisus under a cover with a bunch of lavender sprinkled with a few drops of honey. Some three or four live Bees complete the establishment.

The Bees pay no heed to their redoubtable neighbour. They flutter around the trellised enclosure; from time to time they go and take a sip from the honeyed flowers, sometimes quite close to the Spider, not a quarter of an inch away. They seem utterly unaware of their danger. The experience of

centuries has taught them nothing about the terrible cut-throat. The Thomisus, on her side, waits motionless on a spike of lavender, near the honey. Her four front legs, which are longer than the others, are spread out and slightly raised, in readiness for attack.

A Bee comes to drink at the drop of honey. This is the moment. The Spider springs forward and with her fangs seizes the imprudent one by the tip of the wings, while her legs hold the victim in a tight embrace. A few seconds pass, during which the Bee struggles as best she can against the aggressor on her back, out of the reach of her dagger. This fight at close quarters cannot last long; the Bee would release herself from the other's grip. And so the Spider lets go the wing and suddenly bites her prey in the back of the neck. Once the fangs drive home, it is all over: death ensues. The Bee is slain. Of her turbulent activity naught lingers but some faint quivers of the tarsi, final convulsions which are soon at an end.

Still holding her prey by the nape of the neck, the Thomisus feasts not on the body, which remains intact, but on the blood, which is slowly sucked. When the neck is drained dry, another spot is attacked, on the ab-

domen, the thorax, anywhere. This explains why my observations in the open air showed me the Thomisus with her fangs fixed now in the neck, now in some other part of the Bee. In the first case, the capture was a recent one and the murderess still retained her original posture; in the second case, it had been made some time before; and the Spider had forsaken the wound in the head, now sucked dry, to bite into some other juicy part, no matter which.

Thus shifting her fangs, a trifle this way or that, as she drains her prey, the little ogress gorges on her victim's blood with voluptuous deliberation. I have seen the meal last for seven consecutive hours; and even then the prey was let go only because of the shock given to its devourer by my indiscreet examination. The abandoned corpse, a carcass of no value to the Spider, is not dismembered in any way. There is not a trace of bitten flesh, not a wound that shows. The Bee is drained of her blood; and that is all.

My friend Bull, when he was alive, used to catch an enemy whose teeth threatened danger by the skin of the neck. His method is in general use throughout the canine race.

There, in front of you, is a growling pair of jaws, open, white with foam, ready to bite. The most elementary prudence advises you to keep them quiet by catching hold of the back of the neck.

In her fight with the Bee, the Spider has not the same object. What has she to fear from her victim? The sting before all things, the terrible dart whose least stab would destroy her. And yet she does not trouble about it. What she makes for is the back of the neck, that alone and never anything else, so long as the prey remains alive. In so doing she does not aim at copying the tactics of the Dog and depriving the head, which is not particularly dangerous, of its power of movement. Her plan is farther-reaching and is revealed to us by the lightning death of the Bee. The neck is no sooner gripped than the victim expires. The cerebral centres therefore are injured, poisoned with a deadly virus; and life is straightway extinguished at its very seat. This avoids a struggle which, if prolonged, would certainly end in the aggressor's discomfiture. The Bee has her strength and her sting on her side; the delicate Thomisus has on hers a profound knowledge of the art of murder.

The Mantis: her Hunting

Let us return to the Mantis, who likewise has mastered the first principles of speedy and scientific killing, in which the little Bee-slaughtering Spider excels. A sturdy Locust is captured; sometimes a powerful Grasshopper. The Mantis naturally wants to devour the victuals in peace, without being troubled by the plunges of a victim who absolutely refuses to be devoured. A meal liable to interruptions lacks savour. Now the principal means of defence in this case are the hind-legs, those vigorous levers which can kick out so brutally and which moreover are armed with toothed saws that would rip open the Mantis' bulky paunch if by ill-luck they happen to graze it. What shall we do to reduce them to helplessness, together with the others, which are not dangerous but troublesome all the same, with their desperate gesticulations?

Strictly speaking, it would be practicable to cut them off one by one. But that is a long process and attended with a certain risk. The Mantis has hit upon something better. She has an intimate knowledge of the anatomy of the spine. By first attacking her prize at the back of the half-opened neck and munching the cervical ganglia, she de-

stroys the muscular energy at its main seat; and inertia supervenes, not suddenly and completely, for the clumsily-constructed Locust has not the Bee's exquisite and frail vitality, but still sufficiently, after the first mouthfuls. Soon the kicking and the gesticulating die down, all movement ceases and the game, however big it be, is consumed in perfect quiet.

Among the hunters, I have before now drawn a distinction between those who paralyse and those who kill.[1] Both terrify one with their anatomical knowledge. To-day let us add to the killers the Thomisus, that expert in stabbing in the neck, and the Mantis, who, to devour a powerful prey at her ease, deprives it of movement by first gnawing its cervical ganglia.

[1] Cf. *The Hunting Wasps: passim.—Translator's Note.*

CHAPTER VII

THE MANTIS: HER LOVE-MAKING

THE little that we have seen of the Mantis' habits hardly tallies with what we might have expected from her popular name. To judge by the term *Prègo-Diéu,* we should look to see a placid insect, deep in pious contemplation; and we find ourselves in the presence of a cannibal, of a ferocious spectre munching the brain of a panic-stricken victim. Nor is even this the most tragic part. The Mantis has in store for us, in her relations with her own kith and kin, manners even more atrocious than those prevailing among the Spiders, who have an evil reputation in this respect.

To reduce the number of cages on my big table and give myself a little more space while still retaining a fair-sized menagerie, I instal several females, sometimes as many as a dozen, under one cover. So far as accommodation is concerned, no fault can be found

with the common lodging. There is room and to spare for the evolutions of my captives, who naturally do not want to move about much with their unwieldy bellies. Hanging to the trelliswork of the dome, motionless they digest their food or else await an unwary passer-by. Even so do they act when at liberty in the thickets.

Cohabitation has its dangers. I know that even Donkeys, those peace-loving animals, quarrel when hay is scarce in the manger. My boarders, who are less complaisant, might well, in a moment of dearth, become sour-tempered and fight among themselves. I guard against this by keeping the cages well supplied with Locusts, renewed twice a day. Should civil war break out, famine cannot be pleaded as the excuse.

At first, things go pretty well. The community lives in peace, each Mantis grabbing and eating whatever comes near her, without seeking strife with her neighbours. But this harmonious period does not last long. The bellies swell, the eggs are ripening in the ovaries, marriage and laying-time are at hand. Then a sort of jealous fury bursts out, though there is an entire absence of males who might be held responsible for

feminine rivalry. The working of the ovaries seems to pervert the flock, inspiring its members with a mania for devouring one another. There are threats, personal encounters, cannibal feasts. Once more the spectral pose appears, the hissing of the wings, the fearsome gesture of the grapnels outstretched and uplifted in the air. No hostile demonstration in front of a Grey Locust or White-faced Decticus could be more menacing.

For no reason that I can gather, two neighbours suddenly assume their attitude of war. They turn their heads to right and left, provoking each other, exchanging insulting glances. The "Puff! Puff!" of the wings rubbed by the abdomen sounds the charge. When the duel is to be limited to the first scratch received, without more serious consequences, the lethal fore-arms, which are usually kept folded, open like the leaves of a book and fall back sideways, encircling the long bust. It is a superb pose, but less terrible than that adopted in a fight to the death.

Then one of the grapnels, with a sudden spring, shoots out to its full length and strikes the rival; it is no less abruptly with-

drawn and resumes the defensive. The adversary hits back. The fencing is rather like that of two Cats boxing each other's ears. At the first blood drawn from her flabby paunch, or even before receiving the least wound, one of the duellists confesses herself beaten and retires. The other furls her battle-standard and goes off elsewhither to meditate the capture of a Locust, keeping apparently calm, but ever ready to repeat the quarrel.

Very often, events take a more tragic turn. At such times, the full posture of the duels to the death is assumed. The murderous fore-arms are unfolded and raised in the air. Woe to the vanquished! The other seizes her in her vice and then and there proceeds to eat her, beginning at the neck, of course. The loathsome feast takes place as calmly as though it were a matter of crunching up a Grasshopper. The diner enjoys her sister as she would a lawful dish; and those around do not protest, being quite willing to do as much on the first occasion.

Oh, what savagery! Why, even Wolves are said not to eat one another. The Mantis has no such scruples; she banquets off her fellows when there is plenty of her favourite

game, the Locust, around her. She practises the equivalent of cannibalism, that hideous peculiarity of man.

These aberrations, these child-bed cravings can reach an even more revolting stage. Let us watch the pairing and, to avoid the disorder of a crowd, let us isolate the couples under different covers. Each pair shall have its own home, where none will come to disturb the wedding. And let us not forget the provisions, with which we will keep them well supplied, so that there may be no excuse of hunger.

It is near the end of August. The male, that slender swain, thinks the moment propitious. He makes eyes at his strapping companion; he turns his head in her direction; he bends his neck and throws out his chest. His little pointed face wears an almost impassioned expression. Motionless, in this posture, for a long time he contemplates the object of his desire. She does not stir, is as though indifferent. The lover, however, has caught a sign of acquiescence, a sign of which I do not know the secret. He goes nearer; suddenly he spreads his wings, which quiver with a convulsive tremor. That is his declaration. He rushes, small as he is, upon

the back of his corpulent companion, clings on as best he can, steadies his hold. As a rule, the preliminaries last a long time. At last, coupling takes place and is also long drawn out, lasting sometimes for five or six hours.

Nothing worthy of attention happens between the two motionless partners. They end by separating, but only to unite again in a more intimate fashion. If the poor fellow is loved by his lady as the vivifier of her ovaries, he is also loved as a piece of highly-flavoured game. And, that same day, or at latest on the morrow, he is seized by his spouse, who first gnaws his neck, in accordance with precedent, and then eats him deliberately, by little mouthfuls, leaving only the wings. Here we have no longer a case of jealousy in the harem, but simply a depraved appetite.

I was curious to know what sort of reception a second male might expect from a recently fertilized female. The result of my enquiry was shocking. The Mantis, in many cases, is never sated with conjugal raptures and banquets. After a rest that varies in length, whether the eggs be laid or not, a second male is accepted and then devoured

like the first. A third succeeds him, performs his function in life, is eaten and disappears. A fourth undergoes a like fate. In the course of two weeks I thus see one and the same Mantis use up seven males. She takes them all to her bosom and makes them all pay for the nuptial ecstasy with their lives.

Orgies such as this are frequent, in varying degrees, though there are exceptions. On very hot days, highly charged with electricity, they are almost the general rule. At such times the Mantes are in a very irritable mood. In the cages containing a large colony, the females devour one another more than ever; in the cages containing separate pairs, the males, after coupling, are more than ever treated as an ordinary prey.

I should like to be able to say, in mitigation of these conjugal atrocities, that the Mantis does not behave like this in a state of liberty; that the male, after doing his duty, has time to get out of the way, to make off, to escape from his terrible mistress, for in my cages he is given a respite, lasting sometimes until next day. What really occurs in the thickets I do not know, chance, a poor resource, having never instructed me

concerning the love-affairs of the Mantis when at large. I can only go by what happens in the cages, where the captives, enjoying plenty of sunshine and food and spacious quarters, do not seem to suffer from home-sickness in any way. What they do here they must also do under normal conditions.

Well, what happens there utterly refutes the idea that the males are given time to escape. I find, by themselves, a horrible couple engaged as follows. The male, absorbed in the performance of his vital functions, holds the female in a tight embrace. But the wretch has no head; he has no neck; he has hardly a body. The other, with her muzzle turned over her shoulder continues very placidly to gnaw what remains of the gentle swain. And, all the time, that masculine stump, holding on firmly, goes on with the business!

Love is stronger than death, men say. Taken literally, the aphorism has never received a more brilliant confirmation. A headless creature, an insect amputated down to the middle of the chest, a very corpse persists in endeavouring to give life. It will not let go until the abdomen, the seat of the procreative organs, is attacked.

Eating the lover after consummation of marriage, making a meal of the exhausted dwarf, henceforth good for nothing, can be understood, to some extent, in the insect world, which has no great scruples in matters of sentiment; but gobbling him up during the act goes beyond the wildest dreams of the most horrible imagination. I have seen it done with my own eyes and have not yet recovered from my astonishment.

Was this one able to escape and get out of the way, caught as he was in the midst of his duty? Certainly not. Hence we must infer that the loves of the Mantis are tragic, quite as much as the Spider's and perhaps even more so. I admit that the restricted space inside the cages favours the slaughter of the males; but the cause of these massacres lies elsewhere.

Perhaps it is a relic of the palæozoic ages, when, in the carboniferous period, the insect came into being as the result of monstrous amours. The Orthoptera, to whom the Mantes belong, are the first-born of the entomological world. Rough-hewn, incomplete in their transformation, they roamed among the arborescent ferns and were already flourishing when none of the insects

with delicate metamorphoses, Butterflies, Moths, Beetles, Flies and Bees, as yet existed. Manners were not gentle in those days of passion eager to destroy in order to produce; and the Mantes, a faint memory of the ghosts of old, might well continue the amorous methods of a bygone age.

The habit of eating the males is customary among other members of the Mantis family. I am indeed prepared to admit that it is general. The little Grey Mantis, who looks so sweet and so peaceable in my cages, never seeking a quarrel with her neighbours however crowded they may be, bites into her male and feeds on him as fiercely as the Praying Mantis herself. I wear myself out, scouring the country to procure the indispensable complement to my gynæceum. No sooner is my powerfully-winged and nimble prize introduced than, most often, he is clawed and eaten up by one of those who no longer need his aid. Once the ovaries are satisfied, the Mantes of both species abhor the male, or rather look upon him as nothing better than a choice piece of venison.

CHAPTER VIII

THE MANTIS: HER NEST

LET us show the insect of the tragic amours under a more attractive aspect. Its nest is a marvel. In scientific language it is called *ootheca,* the egg-case. I shall not overwork this outlandish term. We do not say, "the Chaffinch's egg-case," when we mean, "the Chaffinch's nest:" why should I be obliged to talk about a case when I speak of the Mantis? It may sound more learned; but that is not my business.

The nest of the Praying Mantis is found more or less everywhere in sunny places, on stones, wood, vine-stocks, twigs, dry grass and even on products of human industry, such as bits of brick, strips of coarse linen or the hard, shrivelled leather of an old boot. Any support serves, without distinction, so long as there is an uneven surface to which the bottom of the nest can be fixed, thus securing a solid foundation.

The usual dimensions are four centimetres in length and two in width.[1] The colour is as golden as a grain of wheat. When set alight, the material burns readily and exhales a faint smell of singed silk. The substance is in fact akin to silk; only, instead of being drawn into thread, it has curdled into a frothy mass. When the nest is fixed to a branch, the base goes round the nearest twigs, envelops them and assumes a shape which varies in accordance with the support encountered; when it is fixed to a flat surface, the under side, which is always moulded on the support, is itself flat. The nest thereupon takes the form of a semi-ellipsoid, more or less blunt at one end, tapering at the other and often ending in a short, curved tail.

Whatever the support, the upper surface of the nest is systematically convex. We can distinguish in it three well-marked longitudinal zones. The middle one, which is narrower than the others, is composed of little plates or scales arranged in pairs and overlapping like the tiles of a roof. The edges of these plates are free, leaving two parallel rows of slits or fissures through

[1] 1.56 in. × .78 in.—*Translator's Note.*

which the young emerge at hatching-time. In a recently-abandoned nest, this middle zone is furry with gossamer skins, discarded by the larvæ. These cast skins flutter at the least breath and soon vanish when exposed to rough weather. I will call it the exit-zone, because it is only along this median belt that the liberation of the young takes place, thanks to the outlets contrived beforehand.

In every other part the cradle of the numerous family presents an impenetrable wall. The two side zones, in fact, which occupy the greater part of the semiellipsoid, have perfect continuity of surface. The little Mantes, so feeble at the start, could never make their way out through so tough a substance. All that we see on it is a number of fine, transversal furrows, marking the various layers of which the mass of eggs consists.

Cut the nest across. It will now be perceived that the eggs, taken together, form an elongated kernel, very hard and firm and coated on the sides with a thick, porous rind, like solidified foam. Above are curved plates, set very closely and almost independent of one another; their edges end in

the exit-zone, where they form a double row of small, imbricated scales.

The eggs are buried in a yellow matrix of horny appearance. They are placed in layers, shaped like segments of a circle, with the ends containing the heads converging towards the exit-zone. This arrangement tells us how the deliverance is accomplished. The new-born larvæ will slip into the space left between two adjoining plates, a prolongation of the kernel, where they will find a narrow passage, difficult to go through, but just sufficient when we bear in mind the curious provision of which we shall speak presently; and by so doing they will reach the middle belt. Here, under the imbricated scales, two outlets open for each layer of eggs. Half of the larvæ undergoing their liberation will emerge through the right door, half through the left. And this is repeated for each layer from end to end of the nest.

To sum up these structural details, which are rather difficult to grasp for any one who has not the thing in front of him: lying along the axis of the nest and shaped like a date-stone is the cluster of eggs, grouped in layers. A protecting rind, a sort of solidified foam, surrounds this cluster, except at the top along

the median line, where the frothy rind is replaced by thin plates set side by side. The free ends of these plates form the exit-zone outside; they are imbricated in two series of scales and leave a couple of outlets, narrow clefts, for each layer of eggs.

The most striking part of my researches was being present at the construction of the nest and seeing how the Mantis goes to work to produce so complex a building. I managed it with some difficulty, for the laying takes place without warning and nearly always at night. After much useless waiting, chance at last favoured me. On the 5th of September, one of my boarders, who had been fertilized on the 29th of August, decided to lay her eggs before my eyes at about four o'clock in the afternoon.

Before watching her labour, let us note one thing: all the nests that I have obtained in the cages—and there are a good many of them—have as their support, with not a single exception, the wire gauze of the covers. I had taken care to place at the Mantes' disposal a few rough bits of stone, a few tufts of thyme, foundations very often used in the open fields. My captives preferred the wire network, whose meshes fur-

nish a perfectly safe support as the soft material of the building becomes encrusted in them.

The nests, under natural conditions, enjoy no shelter; they have to endure the inclemencies of winter, to withstand rain, wind, frost and snow without coming loose. Therefore the mother always chooses an uneven support for the nest, so that the foundations can be wedged into it and a firm hold obtained. But, when circumstances permit, the better is preferred to the middling and the best to the better; and this must be the reason why the trelliswork of the cages is invariably adopted.

The only Mantis that I have been allowed to observe while engaged in laying does her work upside down, hanging from the top of the cage. My presence, my magnifying-glass, my investigations do not disturb her at all, so great is her absorption in her labour. I can raise the trellised dome, tilt it, turn it over, spin it this way and that, without the insect's suspending its task for a moment. I can take my forceps and lift the long wings to see what is happening underneath. The Mantis takes no notice. Up to this point, all is well: the mother does not move and

impassively endures all the indiscretions of which I am guilty as an observer. And yet things do not go quite as I could wish, for the operation is too rapid and is too difficult to follow.

The end of the abdomen is immersed the whole time in a sea of foam, which prevents us from grasping the details of the process with any clearness. This foam is greyish-white, a little sticky and almost like soapsuds. When it first appears, it adheres slightly to a straw which I dip into it, but, two minutes afterwards, it is solidified and no longer sticks to the straw. In a very short time, its consistency is that which we find in an old nest.

The frothy mass consists mainly of air imprisoned in little bubbles. This air, which gives the nest a volume much greater than that of the Mantis' belly, obviously does not come from the insect, though the foam appears at the entrance of the genital organs; it is taken from the atmosphere. The Mantis, therefore, builds above all with air, which is eminently suited to protect the nest against the weather. She discharges a sticky substance, similar to the caterpillars' silk-fluid; and with this composition, which amal-

gamates instantly with the outer air, she produces foam.

She whips her product just as we whip white of egg to make it rise and froth. The tip of the abdomen, opening with a long cleft, forms two lateral ladles which meet and separate with a constant, rapid movement, beating the sticky fluid and turning it into foam as it is discharged outside. In addition, between the two flapping ladles, we see the internal organs rising and falling, appearing and disappearing, after the manner of a piston-rod, without being able to distinguish their precise action, drowned as they are in the opaque stream of foam.

The end of the abdomen, ever throbbing, quickly opening and closing its valves, swings from right to left and left to right like a pendulum. The result of each swing is a layer of eggs inside and a transversal furrow outside. As the abdomen advances in the arc described, suddenly and at very close intervals it dips deeper into the foam, as though it were pushing something to the bottom of the frothy mass. Each time, no doubt, an egg is laid; but things happen so fast and under conditions so unfavourable to observation that I never once succeed in

seeing the ovipositor at work. I can judge of the arrival of the eggs only by the movements of the tip of the abdomen, which suddenly drives down and immerses itself more deeply.

At the same time, the viscous stuff is poured forth in intermittent waves and whipped and turned into foam by the two terminal valves. The froth obtained spreads over the sides of the layer of eggs and at the base, where I see it, pressed back by the abdomen, projecting through the meshes of the gauze. Thus the spongy covering is gradually brought into being as the ovaries are emptied.

I imagine, without being able to rely on direct observation, that for the central kernel, where the eggs are contained in a more homogeneous material than the rind, the Mantis employs her product as it is, without beating it up and making it foam. When the eggs are deposited, the two valves would produce foam to cover them. Once again, however, all this is very difficult to follow under the veil of the bubbling mass.

In a new nest, the exit-zone is coated with a layer of fine porous matter, of a pure, dull, almost chalky white, which contrasts with

the dirty white of the remainder of the nest. It is like the composition which confectioners make out of whipped white of egg, sugar and starch, with which to ornament their cakes. This snowy covering is very easily crumbled and removed. When it is gone, the exit-zone is clearly defined, with its two rows of plates with free edges. The weather, the wind and the rain sooner or later remove it in strips and flakes; and therefore the old nests retain no traces of it.

At the first inspection, one might be tempted to look upon this snowy matter as a different substance from the remainder of the nest. But can it be that the Mantis really employs two different products? By no means. Anatomy, to begin with, assures us of the unity of the materials. The organ that secretes the substance of the nest consists of twisted cylindrical tubes, divided into two sections of twenty each. All are filled with a colourless, viscous fluid, exactly similar in appearance wherever we look. There is nowhere any sign of a product with a chalky colouring.

The manner in which the snowy ribbon is formed also makes us reject the theory of different materials. We see the Mantis' two

caudal threads sweeping the surface of the foamy mass, skimming, so to speak, the top of the froth, collecting it and retaining it along the back of the nest to form a band that looks like a ribbon of icing. What remains after this sweeping, or what trickles from the band before it sets, spreads over the sides in a thin wash of bubbles so fine that they cannot be seen without the magnifying-glass.

The surface of a muddy stream containing clay will be covered with coarse and dirty foam, churned up by the rushing torrent. On this foam, soiled with earthy materials, we see here and there masses of beautiful white froth, with smaller bubbles. Selection is due to the difference in density; and so the snow-white foam in places lies on top of the dirty foam whence it proceeds. Something similar happens when the Mantis builds her nest. The twin ladles reduce to foam the sticky spray from the glands. The thinnest and lightest portion, made whiter by its more delicate porousness, rises to the surface, where the caudal threads sweep it up and gather it into a snowy ribbon along the back of the nest.

Until now, with a little patience, observa-

tion has been practicable and has given satisfactory results. It becomes impossible when we come to the very complex structure of that middle zone where exits are contrived for the emergence of the larvæ under the shelter of a double row of imbricated plates. The little that I am able to make out amounts to this: the tip of the abdomen, split wide from top to bottom, forms a sort of buttonhole whose upper end remains almost fixed while the lower end, in swinging, produces foam and immerses eggs in it. It is that upper end which is undoubtedly responsible for the work of the middle zone. I always see it in the extension of that zone, in the midst of the fine white foam collected by the caudal filaments. These, one on the right, the other on the left, mark the boundaries of the band. They feel its edges; they seem to be testing the work. I can easily imagine them two long and exquisitely delicate fingers controlling the difficult business of construction.

But how are the two rows of scales obtained and the fissures, the exit-doors, which they shelter? I do not know. I cannot even guess. I leave the rest of the problem to others.

What a wonderful mechanism is this which emits so methodically and swiftly the horny matrix of the central kernel, the protecting froth, the white foam of the median ribbon, the eggs and the fertilizing fluid and which at the same time is able to build overlapping plates, imbricated scales and alternating open fissures! We are lost in admiration. And yet how easily the work is done! The Mantis hangs motionless on the wire gauze which is the foundation of her nest. She gives not a glance at the edifice that is rising behind her; her legs are not called upon for assistance of any kind. The thing works of itself. We have here not an industrial task requiring the cunning of instinct; it is a purely automatic process, regulated by the insect's tools and organization. The nest, with its highly complicated structure, proceeds solely from the play of the organs, even as in our own industries we manufacture by machinery a host of objects whose perfection would outwit our manual dexterity.

From another point of view, the Mantis' nest is more remarkable still. We see in it a superb application of one of the most beautiful principles of physics, that of the con-

servation of heat. The Mantis anticipated us in a knowledge of non-conducting bodies.

We owe to Rumford,[1] the natural philosopher, the following curious experiment, which fittingly demonstrates the low conductivity of the air. The illustrious scientist dropped a frozen cheese into a mass of foam supplied by well-beaten eggs. The whole was subjected to the heat of an oven. The result in a short time was an *omelette soufflée* hot enough to burn the tongue, with the cheese in the middle as cold as at the beginning. The air contained in the bubbles of the surrounding froth explains the strange phenomenon. As an exceedingly poor thermal conductor, it had arrested the heat of the oven and prevented it from reaching the frozen substance in the centre.

Now what does the Mantis do? Precisely the same as Rumford: she whips her white of egg into an *omelette soufflée,* to protect the eggs collected into a central kernel. Her aim, it is true, is reversed: her coagulated foam is intended to ward off the cold, not the heat. But a protection against

[1] Benjamin Thompson (1753-1814), an American loyalist, created Count Rumford in Bavaria, where he became minister for war. He discovered the convertibility of mechanical energy into heat.—*Translator's Note.*

one is a protection against the other; and the ingenious physicist, had he wished, could easily with the same frothy wrapper have maintained the heat of a body in cold surroundings.

Rumford knew the secrets of the stratum of air thanks to the accumulated knowledge of his ancestors, his own researches and his own studies. How is it that for no one knows how many centuries the Mantis has beaten our natural philosophers in the matter of this delicate problem of heat? How did she come to think of wrapping a blanket of foam around her mass of eggs, which, fixed without any shelter to a twig or stone, has to endure the rigours of winter with impunity?

The other Mantidæ of my neighbourhood, the only ones of whom I can speak with full knowledge, use the non-conducting wrapper of solidified foam or do without it, according as the eggs are destined to live through the winter or not. The little Grey Mantis, who differs so greatly from the other owing to the almost entire absence of wings in the female, builds a nest not quite so big as a cherry-stone and covers it very cleverly with a rind of froth. Why this beaten-up en-

velope? Because the nest of the Grey Mantis, like that of the Praying Mantis, has to last through the winter, exposed on its bough or stone to all the dangers of the bad weather.

On the other hand, in spite of her size, which is equal to that of the Praying Mantis, *Empusa pauperata,* who is the most curious of our insects, builds a nest as small as that of the Grey Mantis. It is a very modest edifice, consisting of a small number of cells set side by side in three or four rows joined together. Here there is no frothy envelope at all, though the nest, like those mentioned above, is fixed in an exposed situation on some twig or broken stone. This absence of a non-conducting mattress points to a difference in climatic conditions. The Empusa's eggs, in fact, hatch soon after they are laid, during the fine weather. Not having to undergo the inclemencies of winter, they have no protection but the slender sheath of their cases.

Are these scrupulous and rational precautions, which rival Rumford's *omelette soufflée,* a casual result, one of those numberless combinations turned out by the wheel of fortune? If so, let us not shrink from any absurdity, but recognize straightway that the

blindness of chance is endowed with marvellous foresight.

The blunt end of the nest is the first part built by the Praying Mantis and the tapering end the last. The latter is often prolonged into a sort of spur made by drawing out the final drop of albuminous fluid used. To complete the whole thing demands about two hours of concentrated work, free from interruption.

As soon as the laying is finished, the mother withdraws, callously. I expected to see her return and display some tender feeling for the cradle of her family. But there is not the least sign of maternal joy. The work is done and possesses no further interest for her. Some Locusts have come up. One even perches on the nest. The Mantis pays no attention to the intruders. They are peaceful, it is true. Would she drive them away if they were dangerous and if they looked like ripping open the egg-casket? Her impassive behaviour answers no. What is the nest to her henceforth? She knows it no more.

I have spoken of the repeated coupling of the Praying Mantis and of the tragic end of the male, who is nearly always devoured like

an ordinary piece of game. In the space of a fortnight I have seen the same female marry again as many as seven times over. Each time the easily-consoled widow ate up her mate. Such habits make one assume repeated layings; and these do, in fact, take place, though they are not the general rule. Among my mothers, some gave me only one nest; others supplied me with two, both equally large. The most fertile produced three, of which the first two were of normal size, while the third was reduced to half the usual dimensions.

The last-mentioned insect shall tell us the population which the Mantis' ovaries are capable of producing. Reckoning by the transversal furrows of the nest, we can easily count the layers of eggs. These are more or less rich according to their position at the middle of the ellipsoid or at the ends. The numbers of the eggs in the biggest and in the smallest layer furnish an average from which we can approximately deduce the total. In this way I find that a good-sized nest contains about four hundred eggs. The mother with the three nests, the last of which was only half the size of the others, therefore left as her offspring no fewer than a thou-

sand germs; those who laid twice left eight hundred; and the less fertile mothers three to four hundred. In every case, it is a fine family, which would even become cumbrous, if it were not subjected to drastic pruning.

The pretty little Grey Mantis is much less lavish. In my cages she lays only once; and her nest contains some sixty eggs at most. Although built on the same principles and likewise fixed in the open, it differs remarkably from the work of the Praying Mantis, first in its scanty dimensions and next in certain details of structure. It is shaped like a shelving ridge. The two sides are curved and the median line projects into a slightly denticulated crest. It is grooved crosswise by about a dozen furrows, corresponding with the several layers of eggs. Here we find no exit-zone, with short, imbricated scales; no snowy ribbon with alternating outlets. The whole surface, including the foundation, is uniformly covered with a shiny red-brown rind, in which the bubbles are very small. One end is ogival in shape; the other, the end where the nest finishes, is abruptly truncated and is prolonged above in a short spur. The whole forms a kernel surrounded by the foamy rind. Like the Praying

Mantis, the Grey Mantis works at night, an unfortunate circumstance for the observer.

Large in size, curious in build and moreover plainly visible on its stone or its bit of brushwood, the Praying Mantis' nest could not fail to attract the attention of the Provençal peasant. It is, in fact, very well-known in the country districts, where it bears the name of *tigno;* it even enjoys a great reputation. Yet nobody seems to be aware of its origin. It is always a matter for surprise to my rustic neighbours when I inform them that the famous *tigno* is the nest of the common *Prègo-Diéu.* Their ignorance might well be due to the Mantis' habit of laying her eggs at night. The insect has never been caught working at her nest in the mysterious darkness; and the link between the worker and the work is missing, though both are known to every one in the village.

No matter: the singular object exists; it attracts the eye, it captivates the attention. It must therefore be good for something, it must possess virtues. Thus, throughout the ages, have the ingenuous argued, hoping to find in the unfamiliar an alleviation of their pains.

By general consent, the rural pharma-

copœia, in Provence, extols the *tigno* as the best remedy against chilblains. The way to employ it is exceedingly simple. You cut the thing in two, squeeze it and rub the afflicted part with the streaming juice. The remedy, they say, works like a charm. Every one mad with the itching of blue and swollen fingers hastens to have recourse to the *tigno*, according to traditional custom. Does he really obtain relief?

Notwithstanding the unanimous conviction, I venture to doubt it, after the fruitless experiments tried upon myself and other members of my household during the winter of 1895, when the long and severe frost produced any amount of epidermic discomfort. Not one of us, when smeared with the celebrated ointment, saw the chilblains on his fingers decrease nor felt the irritation relieved in the slightest degree by the albuminous varnish of the crushed *tigno*. It seems probable that others are no more successful and that the popular reputation of the specific nevertheless survives, probably because of a mere identity of name between the remedy and the disease: the Provençal for chilblain is *tigno*. Once that the nest of the Praying Mantis and the chilblain are

known by the same name, do not the virtues of the former become obvious? That is how reputations are created.

In my village and no doubt for some distance around, the *tigno*—I am now speaking of the Mantis' nest—is also highly praised as a wonderful cure for toothache. As long as you have it on you, you need never fear that trouble. Our housewives gather it under a favourable moon; they preserve it religiously in a corner of the press; they sew it into their pocket, lest they should lose it when taking out their handkerchief; and neighbours borrow it when tortured by some molar.

"Lend me your *tigno:* I am in agony," says the sufferer with the swollen face.

The other hastens to unstitch and to hand over the precious object:

"Don't lose it, whatever you do," she impresses on her friend. "It's the only one I have; and this isn't the right time of moon."

Let us not laugh at this eccentric toothache-nostrum: many remedies that sprawl triumphantly over the back pages of the newspapers are no more effective. Besides, this rural simplicity is surpassed by some old books in which slumbers the

science of by-gone days. An English naturalist of the sixteenth century, Thomas Moffett, the physician,[1] tells us that, if a child lose his way in the country, he will ask the Mantis to put him on his road. The Mantis, adds the author, "will stretch out one of her feet and shew him the right way and seldome or never misse." These charming things are told with adorable simplicity:

"Tam divina censetur bestiola, ut puero interroganti de via, extento digito rectam monstrat atque raro vel nunquam fallat."

Where did the credulous scholar get this pretty story? Not in England, where the Mantis cannot live; not in Provence, where we find no trace of the boyish question. All said, I prefer the spiflicating virtues of the *tigno* to the old naturalist's imaginings.

[1] Thomas Moffett, Moufet, or Muffet (1553-1604), author of a posthumous *Insectorum sive Minimorum Animalium Teatrum,* published in Latin in 1634 and in an English translation, by Edward Topsell, in 1658. Although giving credence to too many fabulous reports, Moffett was acknowledged the prince of entomologists prior to the advent of Jan Swammerdam (1637-1680).—*Translator's Note.*

CHAPTER IX

THE MANTIS: HER HATCHING

THE eggs of the Praying Mantis usually hatch in bright sunshine, at about ten o'clock on a mid-June morning. The median band or exit-zone is the only portion of the nest that affords an outlet to the youngsters.

From under each scale of that zone we see slowly appearing a blunt, transparent protuberance, followed by two large black specks, which are the eyes. Softly the newborn grub slips under the thin plate and half-releases itself. Is it the little Mantis in his larval form, so nearly allied to that of the adult? Not yet. It is a transition organism. The head is opalescent, blunt, swollen, with palpitations caused by the flow of the blood. The rest is tinted reddish-yellow. It is quite easy to distinguish, under a general overall, the large black eyes clouded by the veil that covers them, the mouth-parts flattened against the chest, the legs plastered to the

body from front to back. Altogether, with the exception of the very obvious legs, the whole thing, with its big blunt head, its eyes, its delicate abdominal segmentation and its boatlike shape, reminds us somewhat of the first state of the Cicadæ on leaving the egg, a state which is pictured exactly by a tiny, finless fish.

Here then is a second instance of an organization of very brief duration having as its function to bring into the light of day, through narrow and difficult passes, a microscopic creature whose limbs, if free, would, because of their length, be an insurmountable impediment. To enable him to emerge from the exiguous tunnel of his twig, a tunnel bristling with woody fibres and blocked with shells already empty, the Cicada is born swathed in bands and endowed with a boat shape, which is eminently suited to slipping easily through an awkward passage. The young Mantis is exposed to similar difficulties. He has to emerge from the depths of the nest through narrow, winding ways, in which full-spread, slender limbs would not be able to find room. The high stilts, the murderous harpoons, the delicate antennæ, organs which will be most useful presently, in

the brushwood, would now hinder the emergence, would make it very laborious, impossible. The creature therefore comes into existence swaddled and furthermore takes the shape of a boat.

The case of the Cicada and the Mantis opens up a new vein to us in the inexhaustible entomological mine. I extract from it a law which other and similar facts, picked up more or less everywhere, will certainly not fail to confirm. The true larva is not always the direct product of the egg. When the newborn grub is likely to experience special difficulties in effecting its deliverance, an accessory organism, which I shall continue to call the primary larva, precedes the genuine larval state and has as its function to bring to the light of day the tiny creature which is incapable of releasing itself.

To go on with our story, the primary larvæ show themselves under the thin plates of the exit-zone. A vigorous flow of humours occurs in the head, swelling it out and converting it into a diaphanous and ever-throbbing blister. In this way the splitting-apparatus is prepared. At the same time, the little creature, half-caught under its scale, sways, pushes forward, draws back. Each

swaying is accompanied by an increase of the swelling in the head. At last the prothorax arches and the head is bent low towards the chest. The tunic bursts across the prothorax. The little animal tugs, wriggles, sways, bends and straightens itself again. The legs are drawn from their sheaths; the antennæ, two long parallel threads, are likewise released. The creature is now fastened to the nest only by a worn-out cord. A few shakes complete the deliverance.

We here have the insect in its genuine larval form. All that remains behind is a sort of irregular cord, a shapeless clout which the least breath blows about like a flimsy bit of fluff. It is the exit-tunic violently shed and reduced to a mere rag.

For all my watchfulness, I missed the moment of hatching in the case of the Grey Mantis. The little that I know is reduced to this: at the end of the spur or promontory with which the nest finishes in front is a small, dull-white speck, formed of very powdery foam. This round pore is only just plugged with a frothy stopper and constitutes the sole outlet from the nest, which is thoroughly strengthened at every other part. It takes

the place of the long band of scales through which the Praying Mantis is released. It is here that the youngsters must emerge one by one from their casket. Chance does not favour me and I do not witness the exodus, but, soon after the family has come forth, I see dangling at the entrance to the liberating pore a shapeless bunch of white cast-off clothes, thin skins which a puff of wind would disperse. These are the garments flung aside by the young as they make their appearance in the open air; and they testify to the presence of a transition wrapper which permits of movement inside the maze of the nest. The Grey Mantis therefore also has her primary larva, which packs itself up in a narrow sheath, conducive to escape. The period of this emergence is June.

To return to the Praying Mantis. The hatching does not take place all over the nest at one time, but rather in sections, in successive swarms which may be separated by intervals of two days or more. The pointed end, containing the last eggs, usually begins. This inversion of chronological order, calling the last to the light of day before the first, may well be due to the shape of the nest. The thin end, which is more ac-

cessible to the stimulus of a fine day, wakes up before the blunt end, which is larger and does not so soon acquire the necessary amount of heat.

Sometimes, however, although still broken up in swarms, the hatching embraces the whole length of the exit-zone. A striking sight indeed is the sudden exodus of a hundred young Mantes. Hardly does the tiny creature show its black eyes under a scale before others appear instantly, in their numbers. It is as though a certain shock were being communicated from one to another, as though an awakening signal were transmitted, so swiftly does the hatching spread all round. Almost in a moment the median band is covered with young Mantes who run about feverishly, stripping themselves of their rent garments.

The nimble little creatures do not stay long on the nest. They let themselves drop off or else clamber into the nearest foliage. All is over in less than twenty minutes. The common cradle resumes its peaceful condition, prior to furnishing a new legion a few days later; and so on until all the eggs are finished.

I have witnessed this exodus as often as

I wished to, either out of doors, in my enclosure, where I had deposited in sunny places the nests gathered more or less everywhere during my winter leisure, or else in the seclusion of a greenhouse, where I thought, in my simplicity, that I should be better able to protect the budding family. I have witnessed the hatching twenty times if I have once; and I have always beheld a scene of unforgetable carnage. The round-bellied Mantis may procreate germs by the thousands: she will never have enough to cope with the devourers who are destined to decimate the breed from the moment that it leaves the egg.

The Ants above all are zealous exterminators. Daily I surprise their ill-omened visits on my rows of nests. It is vain for me to intervene, however seriously; their assiduity never slackens. They seldom succeed in making a breach in the fortress: that is too difficult; but, greedy of the dainty flesh in course of formation inside, they await a favourable opportunity, they lie in wait for the exit.

Despite my daily watchfulness, they are there the moment that the young Mantes appear. They grab them by the abdomen, pull

them out of their sheaths, cut them up. You see a piteous fray between tender babes gesticulating as their only means of defence and ferocious brigands carrying their *spolia opima* at the end of their mandibles. In less than no time the massacre of the innocents is consummated; and all that remains of the flourishing family is a few scattered survivors who have escaped by accident.

The future assassin, the scourge of the insect race, the terror of the Locust on the brushwood, the dread devourer of fresh meat, is herself devoured, from her birth, by one of the least of that race, the Ant. The ogress, prolific to excess, sees her family thinned by the dwarf. But the slaughter is not long continued. So soon as she has acquired a little firmness from the air and strengthened her legs, the Mantis ceases to be attacked. She trots about briskly among the Ants, who fall back as she passes, no longer daring to tackle her. With her grappling-legs brought close to her chest, like arms ready for self-defence, already she strikes awe into them by her proud bearing.

A second connoisseur in tender meats pays no heed to these threats. This is the little Grey Lizard, the lover of sunny walls. Ap-

prised I know not how of the quarry, here he comes, picking up one by one, with the tip of his slender tongue, the stray insects that have escaped the Ants. They make a small mouthful but an exquisite one, so it seems, to judge by the blinking of the reptile's eye. For each little wretch gulped down, its lid half-closes, a sign of profound satisfaction. I drive away the bold Lizard who ventures to perpetrate his raid before my eyes. He comes back again and, this time, pays dearly for his rashness. If I let him have his way, I should have nothing left.

Is this all? Not yet. Another ravager, the smallest of all but not the least formidable, has anticipated the Lizard and the Ant. This is a very tiny Hymenopteron armed with a probe, a Chalcis, who establishes her eggs in the newly-built nest. The Mantis' brood shares the fate of the Cicada's: parasitic vermin attack the eggs and empty the shells. Out of all that I have collected I often obtain nothing or hardly anything. The Chalcis has been that way.

Let us gather up what the various exterminators, known or unknown, have left me. When newly hatched, the larva is of a pale hue, white faintly tinged with yellow.

The swelling of its head soon diminishes and disappears. Its colour is not long in darkening and turns light-brown within twenty-four hours. The little Mantis very nimbly lifts up her grappling-legs, opens and closes them; she turns her head to right and left; she curls her abdomen. The fully-developed larva has no greater litheness and agility. For a few minutes the family stops where it is, swarming over the nest; then it scatters at random on the ground and the plants hard by.

I instal a few dozen emigrants under bell-covers. On what shall I feed these future huntresses? On game, obviously. But what game? To these miniature creatures I can only offer atoms. I serve them up a rose-branch covered with Green Fly. The plump Aphis, a tender morsel suited to my feeble guests, is utterly scorned. Not one of the captives touches it.

I try them with Midges, the smallest that chance flings into my net as it sweeps the grass, and meet with the same obstinate refusal. I offer them pieces of Fly, hung here and there on the gauze of the cover. None accepts my quarters of venison. Perhaps the Locust will tempt them, the Locust on

whom the adult Mantis dotes? A prolonged and minute search places me in possession of what I want. This time the bill of fare will consist of a few recently hatched Acridians. Young as they are, they have already reached the size of my charges. Will the little Mantes fancy these? They do not fancy them: at the sight of their tiny prey they run away dismayed.

Then what do you want? What other game do you find on your native brushwood? I can see nothing. Can you have some special infants' food, vegetarian perhaps? Let us even try the improbable. The very tenderest bit of the heart of a lettuce is declined. So are the different sorts of grass which I tax my ingenuity in varying; so are the drops of honey which I place on spikes of lavender. All my endeavours come to nothing; and my captives die of inanition.

My failure has its lessons. It seems to point to a transition diet which I have not been able to discover. Long ago, the larvæ of the Oil-beetles gave me a great deal of trouble, before I knew that they want as their first food the egg of the Bee whose store of honey they will afterwards consume. Perhaps the young Mantes also in the begin-

ning demand a special pap, something more in keeping with their frailty. Despite its resolute air, I do not quite see the feeble little creature hunting. The game, whatever it be, kicks out, when attacked, frisks about, defends itself; and the assailant is not yet in a condition to ward off even the flap of a Midge's wing. Then what does it feed on? I should not be surprised if there were interesting facts to be picked up in this baby-food question.

These fastidious ones, so difficult to provide with nourishment, meet with even more pitiful deaths than hunger. When only just born, they fall a prey to the Ant, the Lizard and other ravagers who lie in wait, patiently, for the exquisite provender to hatch. The egg itself is not respected. An infinitesimal perforator inserts her own eggs in the nest through the barrier of solidified foam, thus settling her offspring, which, maturing earlier, nips the Mantis' family in the bud. How many are called and how few are chosen! There were a thousand of them perhaps, sprung from one mother who was capable of giving birth to three broods. One couple alone escapes extermination, one alone keeps up the breed, seeing that the number re-

mains more or less the same from year to year.

Here a serious question arises. Can the Mantis have acquired her present fecundity by degrees? Can she, as the ravages of the Ant and others reduced her progeny, have increased the output of her ovaries so as to make up for excessive destruction by excessive production? Could the enormous brood of to-day be due to the wastage of former days? So think some, who are ready, without convincing proofs, to see in animals even more profound changes brought about by circumstances.

In front of my window, on the sloping margin of the pond, stands a magnificent cherry-tree. It came there by accident, a sturdy wilding, disregarded by my predecessors and to-day respected far more for its spreading branches than for its fruit, which is of very indifferent quality. In April it forms a splendid white-satin dome. Its blossoms are as snow; their fallen petals carpet the ground. Soon the red cherries appear in profusion. O my beautiful tree, how lavish you are and what a number of baskets you will fill!

And for this reason what revelry up

above! The Sparrow is the first to hear of the ripe cherries and comes trooping, morning and evening, to pilfer and squall; he informs his friends in the neighbourhood, the Greenfinch and the Warbler, who hasten up and banquet for weeks on end. Butterflies flit from one nibbled cherry to another, taking delicious sips at each. Rose-chafers bite great mouthfuls out of the fruit, then fall asleep sated. Wasps and Hornets burst open the sweet caskets; and the Gnats follow to get drunk in their wake. A plump maggot, settled in the very centre of the pulp, blissfully feasts upon its juicy dwelling-house and waxes big and fat. It will rise from table to change into a comely Fly.

On the ground there are others at the banquet. A host of footpads is battening on the fallen cherries. At night, the Field-mice come gathering the stones stripped by the Wood-lice, Earwigs, Ants and Slugs; they hoard them in their burrows. During the long winter they will make holes in them to extract and nibble the kernels. A numberless throng lives upon the generous cherry-tree.

What would the tree require to provide a successor one day and maintain its species

in a state of harmonious and well-balanced prosperity? A single seed would be enough; and every year it gives forth bushels and bushels. Tell me why, please.

Shall we say that the cherry-tree, at first very economical with its fruit, became lavish by degrees in order thus to escape its multitudinous ravagers? Shall we say of the tree, as we said of the Mantis, that excessive destruction gradually induced excessive production? Who would dare to venture on such rash statements? Is it not perfectly obvious that the cherry-tree is one of those factories in which elements are wrought into organic matter, one of those laboratories in which the dead thing is changed into the thing fitted to live? No doubt, cherries ripen that they may be perpetuated; but these are the minority, the very small minority. If all seeds were to sprout and to develop fully, there would long ago have been no room on the earth for the cherry-tree alone. The vast majority of its fruits fulfil another function. They serve as food for a crowd of living creatures, who are not skilled as the plant is in the transcendental chemistry that turns the uneatable into the eatable.

Matter, in order to serve in the highest

manifestations of life, must undergo slow and most delicate elaboration. That elaboration begins in the workshop of the infinitely small, of the microbe, for instance, one of which, more powerful than the lightning's might, combines oxygen and nitrogen and produces nitrates, the primary food of plants. It begins on the confines of nothingness, is improved in the vegetal, is yet further refined in the animal and step by step attains the substance of the brain.

How many hidden labourers, how many unknown manipulators worked perhaps for centuries, first at getting the rough ore and then at the refining of that grey matter which becomes the brain, the most marvellous of the implements of the mind, even if it were capable only of making us say:

"Two and two are four!"

The rocket, when rising, reserves for the culminating point of its ascent the dazzling fountain of its many-coloured lights. Then all is dark again. Its smoke, its gases, its oxides will, in the long run, be able to reconstitute other explosives by vegetable processes. Even so does matter act in its metamorphoses. From stage to stage, from one delicate refinement to another yet more deli-

cate, it succeeds in attaining heights where the splendours of the intellect shine forth through its agency; then, shattered by the effort, it relapses into the nameless thing whence it started, into scattered molecules which are the common origin of living things.

At the head of the assemblers of organic matter stands the plant, the animal's senior. Directly or indirectly, it is to-day, as it was in the geological period, the chief purveyor to beings more generously endowed with life. In the laboratory of its cell the food of the universe at least gets its first rough preparation. Comes the animal, which corrects the preparation, improves it and transmits it to others of a higher order. Cropped grass becomes mutton; and mutton becomes human flesh or Wolf-flesh, according to the consumer.

Among those elaborators of nourishing atoms which do not create organic matter out of any- and everything, starting with the mineral, as the plant does, the most prolific are the fishes, the first-born of vertebrate animals. Ask the Cod what she does with her millions of eggs. Her answer will be that of the beech with its myriads of nuts, or the oak with its myriads of acorns. She

is immensely fruitful in order to feed an immense number of the hungry. She is continuing the work which her predecessors performed in remote ages, when nature, not as yet rich in organic matter, hastened to increase her reserves of life by bestowing prodigious exuberance upon her primeval workers.

The Mantis, like the fish, dates back to those distant epochs. Her strange shape and her uncouth habits have told us so. The richness of her ovaries confirms it. She retains in her entrails a feeble relic of the procreative fury that prevailed in olden times under the dank shade of the arborescent ferns; she contributes, in a very humble but none the less real measure, to the sublime alchemy of living things.

Let us look closely at her work. The grass grows thick and green, drawing its nourishment from the earth. The Locust crops it. The Mantis makes a meal of the Locust and swells out with eggs, which are laid, in three batches, to the number of a thousand. When they hatch, up comes the Ant and levies an enormous tribute on the brood. We appear to be retroceding. In vastness of bulk, yes; in refinement of in-

stinct, certainly not. In this respect how far superior is the Ant to the Mantis! Besides, the cycle of possible happenings is not closed.

Young Ants still contained in their cocoon —popularly known as Ants'-eggs—form the food on which the Pheasant's brood is reared. These are domestic poultry just as much as the Pullet and the Capon, but their keep makes greater demands on the owner's care and purse. When it grows big, this poultry is let loose in the woods; and people calling themselves civilized take the greatest pleasure in bringing down with their guns the poor creatures which have lost the instinct of self-preservation in the pheasantries, or, to speak plainly, in the poultry-yard. You cut the throat of the Chicken required for roasting; you shoot, with all the parade of sport, that other Chicken, the Pheasant. I fail to understand those insensate massacres.

Tartarin of Tarascon, in the absence of game, used to shoot at his cap. I prefer that. And above all I prefer the hunting, real hunting, of another fervent consumer of Ants, the Wryneck, the *Tiro-lengo* of the Provençaux, so-called because of his scientific method of darting his immensely-long

and sticky tongue across a procession of Ants and then suddenly withdrawing it all black with the limed insects. With such mouthfuls as these, the Wryneck becomes disgracefully fat in autumn; he plasters himself with butter on his rump and sides and under his wings; he hangs a string of it round his neck; he pads his skull with it right down to the beak.

He is then delicious, roasted: small, I admit; no bigger than a Lark, at the outside; but, small though he be, unlike anything else and immeasurably superior to the Pheasant, who must begin to go bad before developing a flavour at all.

Let me for this once do justice to the merit of the humblest! When the table is cleared after the evening meal and all is quiet and my body relieved for the time being of its physiological needs, sometimes I succeed in picking up, here and there, a good idea or two; and it may well be that the Mantis, the Locust, the Ant and even lesser creatures contribute to these sudden gleams of light which flash unaccountably into one's mind. By strange and devious paths, they have all supplied, in their respective ways, the drop of oil that feeds the lamp of thought. Their energies, slowly developed, stored up and

handed down by predecessors, become infused into our veins and sustain our weakness. We live by their death.

To conclude. The Mantis, prolific to excess, in her turn makes organic matter, bequeathing it to the Ant, who bequeaths it to the Wryneck, who bequeaths it perhaps to man. She procreates a thousand, partly to perpetuate her species, but far more than she may contribute, according to her means, to the general picnic of the living. She brings us back to the ancient symbol of the Serpent biting its own tail. The world is an endless circle: everything finishes so that everything may begin again; everything dies so that everything may live.

CHAPTER X

THE EMPUSA

THE sea, life's first foster-mother, still preserves in her depths many of those singular and incongruous shapes which were the earliest attempts of the animal kingdom; the land, less fruitful, but with more capacity for progress, has almost wholly lost the strange forms of other days. The few that remain belong especially to the series of primitive insects, insects exceedingly limited in their industrial powers and subject to very summary metamorphoses, if to any at all. In my district, in the front rank of those entomological anomalies which remind us of the denizens of the old coal-forests, stand the Mantidæ, including the Praying Mantis, so curious in habits and structure. Here also is the Empusa (*E. pauperata,* LATR.), the subject of this chapter.

Her larva is certainly the strangest creature among the terrestrial fauna of Pro-

vence: a slim, swaying thing of so fantastic an appearance that uninitiated fingers dare not lay hold of it. The children of my neighbourhood, impressed by its startling shape, call it "the Devilkin." In their imaginations, the queer little creature savours of witchcraft. One comes across it, though always sparsely, in spring, up to May; in autumn; and sometimes in winter, if the sun be strong. The tough grasses of the waste-lands, the stunted bushes which catch the sun and are sheltered from the wind by a few heaps of stones are the chilly Empusa's favourite abode.

Let us give a rapid sketch of her. The abdomen, which always curls up so as to join the back, spreads paddlewise and twists into a crook. Pointed scales, a sort of foliaceous expansions arranged in three rows, cover the lower surface, which becomes the upper surface because of the crook aforesaid. The scaly crook is propped on four long, thin stilts, on four legs armed with knee-pieces, that is to say, carrying at the end of the thigh, where it joins the shin, a curved, projecting blade not unlike that of a cleaver.

Above this base, this four-legged stool, rises, at a sudden angle, the stiff corselet,

disproportionately long and almost perpendicular. The end of this bust, round and slender as a straw, carries the hunting-trap, the grappling limbs, copied from those of the Mantis. They consist of a terminal harpoon, sharper than a needle, and a cruel vice, with jaws toothed like a saw. The jaw formed by the arm proper is hollowed into a groove and carries on either side five long spikes, with smaller indentations in between. The jaw formed by the fore-arm is similarly furrowed, but its double saw, which fits into the groove of the upper arm when at rest, is formed of finer, closer and more regular teeth. The magnifying-glass reveals a score of equal points in each row. The machine only lacks size to be a fearful implement of torture.

The head is in keeping with this arsenal. What a queer-shaped head it is! A pointed face, with walrus moustaches furnished by the palpi; large goggle eyes; between them, a dirk, a halberd blade; and, on the forehead, a mad, unheard-of thing: a sort of tall mitre, an extravagant head-dress that juts forward, spreading right and left into peaked wings and cleft along the top. What does the Devilkin want with that monstrous

pointed cap, than which no wise man of the East, no astrologer of old ever wore a more splendiferous? This we shall learn when we see her out hunting.

The dress is commonplace; grey tints predominate. Towards the end of the larval period, after a few moultings, it begins to give a glimpse of the adult's richer livery and becomes striped, still very faintly, with pale-green, white and pink. Already the two sexes are distinguished by their antennæ. Those of the future mothers are thread-like; those of the future males are distended into a spindle at the lower half, forming a case or sheath whence graceful plumes will spring at a later date.

Behold the creature, worthy of a Callot's [1] fantastic pencil. If you come across it in the bramble-bushes, it sways upon its four stilts, it wags its head, it looks at you with a knowing air, it twists its mitre round and peers over its shoulder. You seem to read mischief in its pointed face. You try to take hold of it. The imposing attitude ceases forthwith, the raised corselet is lowered and

[1] Jacques Callot (1592-1635), the French engraver and painter, famed for the grotesque nature of his subjects.—*Translator's Note.*

the creature makes off with mighty strides, helping itself along with its fighting-limbs, which clutch the twigs. The flight need not last long, if you have a practised eye. The Empusa is captured, put into a screw of paper, which will save her frail limbs from sprains, and lastly penned in a wire-gauze cage. In this way, in October, I obtain a flock sufficient for my purpose.

How to feed them? My Devilkins are very little; they are a month or two old at most. I give them Locusts suited to their size, the smallest that I can find. They refuse them. Nay more, they are frightened of them. Should a thoughtless Locust meekly approach one of the Empusæ, suspended by her four hind-legs to the trellised dome, the intruder meets with a bad reception. The pointed mitre is lowered; and an angry thrust sends him rolling. We have it: the wizard's cap is a defensive weapon, a protective crest. The Ram charges with his forehead, the Empusa butts with her mitre.

But this does not mean dinner. I serve up the House-fly, alive. She is accepted, without hesitation. The moment that the Fly comes within reach, the watchful Devilkin turns her head, bends the stalk of her

corselet slantwise and, flinging out her fore-limb, harpoons the Fly and grips her between her two saws. No Cat pouncing upon a Mouse could be quicker.

The game, however small, is enough for a meal. It is enough for the whole day, often for several days. This is my first surprise: the extreme abstemiousness of these savagely-armed insects. I was prepared for ogres: I find ascetics satisfied with a meagre collation at rare intervals. A Fly fills their belly for twenty-four hours at least.

Thus passes the late autumn: the Empusæ, more and more temperate from day to day, hang motionless from the wire gauze. Their natural abstinence is my best ally, for Flies grow scarce; and a time comes when I should be hard put to it to keep the menageries supplied with provisions.

During the three winter months, nothing stirs. From time to time, on fine days, I expose the cage to the sun's rays, in the window. Under the influence of this heat-bath, the captives stretch their legs a little, sway from side to side, make up their minds to move about, but without displaying any awakening appetite. The rare Midges that fall to my assiduous efforts do not appear to

tempt them. It is a rule for them to spend the cold season in a state of complete abstinence.

My cages tell me what must happen outside, during the winter. Ensconced in the crannies of the rockwork, in the sunniest places, the young Empusæ wait, in a state of torpor, for the return of the hot weather. Notwithstanding the shelter of a heap of stones, there must be painful moments when the frost is prolonged and the snow penetrates little by little into the best-protected crevices. No matter: hardier than they look, the refugees escape the dangers of the winter season. Sometimes, when the sun is strong, they venture out of their hiding-place and come to see if spring be nigh.

Spring comes. We are in March. My prisoners bestir themselves, change their skin. They need victuals. My catering difficulties recommence. The House-fly, so easy to catch, is lacking in these days. I fall back upon earlier Diptera: Eristales, or Drone-flies. The Empusa refuses them. They are too big for her and can offer too strenuous a resistance. She wards off their approach with blows of her mitre.

A few tender morsels, in the shape of very

young Grasshoppers, are readily accepted. Unfortunately, such wind-falls do not often find their way into my sweeping-net. Abstinence becomes obligatory until the arrival of the first Butterflies. Henceforth, *Pieris brassicæ,* the White Cabbage Butterfly, will contribute the greater portion of the victuals.

Let loose in the wire cage, the Pieris is regarded as excellent game. The Empusa lies in wait for her, seizes her, but releases her at once, lacking the strength to overpower her. The Cabbage Butterfly's great wings, beating the air, give her shock after shock and compel her to let go. I come to the weakling's assistance and cut the wings of her prey with my scissors. The maimed ones, still full of life, clamber up the trelliswork and are forthwith grabbed by the Empusæ, who, in no way frightened by their protests, crunch them up. The dish is to their taste and, moreover, plentiful, so much so that there are always some despised remnants.

The head only and the upper portion of the breast are devoured: the rest—the plump abdomen, the best part of the thorax, the legs and lastly, of course, the wing-stumps—is flung aside untouched. Does this mean that

the tenderest and most succulent morsels are chosen? No, for the belly is certainly more juicy; and the Empusa refuses it, though she eats up her House-fly to the last particle. It is a strategy of war. I am again in the presence of a neck-specialist as expert as the Mantis herself in the art of swiftly slaying a victim that struggles and, in struggling, spoils the meal.

Once warned, I soon perceive that the game, be it Fly, Locust, Grasshopper or Butterfly, is invariably struck in the neck, from behind. The first bite is aimed at the point containing the cervical ganglia and produces sudden death or immobility. Complete inertia will leave the consumer in peace, the essential condition of every satisfactory repast.

The Devilkin, therefore, frail though she be, possesses the secret of immediately destroying the resistance of her prey. She bites at the back of the neck first, in order to give the finishing stroke. She goes on nibbling around the original attacking-point. In this way, the Butterfly's head and the upper part of the breast are disposed of. But, by that time, the huntress is surfeited: she wants so little! The rest lies on the

ground, disdained, not for lack of flavour, but because there is too much of it. A Cabbage Butterfly far exceeds the capacity of the Empusa's stomach. The Ants will benefit by what is left.

There is one other matter to be mentioned, before observing the metamorphosis. The position adopted by the young Empusæ in the wire-gauze cage is invariably the same from start to finish. Gripping the trelliswork by the claws of its four hind-legs, the insect occupies the top of the dome and hangs motionless, back downwards, with the whole of its body supported by the four suspension-points. If it wishes to move, the front harpoons open, stretch out, grasp a mesh and draw it to them. When the short walk is over, the lethal arms are brought back against the chest. One may say that it is nearly always the four hind-shanks which alone support the suspended insect.

And this reversed position, which seems to us so trying, lasts for no short while: it is prolonged, in my cages, for ten months without a break. The Fly on the ceiling, it is true, occupies the same attitude; but she has her moments of rest: she flies, she walks in a normal posture, she spreads herself flat

in the sun. Besides, her acrobatic feats do not cover a long period. The Empusa, on the other hand, maintains her curious equilibrium for ten months on end, without a break. Hanging from the trelliswork, back downwards, she hunts, eats, digests, dozes, casts her skin, undergoes her transformation, mates, lays her eggs and dies. She clambered up there when she was still quite young; she falls down, full of days, a corpse.

Things do not happen exactly like this under natural conditions. The insect stands on the bushes back upwards; it keeps its balance in the regular attitude and turns over only in circumstances that occur at long intervals. The protracted suspension of my captives is all the more remarkable inasmuch as it is not at all an innate habit of their race.

It reminds one of the Bats, who hang, head downwards, by their hind-legs from the roof of their caves. A special formation of the toes enables birds to sleep on one leg, which automatically and without fatigue clutches the swaying bough. The Empusa shows me nothing akin to their contrivance. The extremity of her walking-legs has the

ordinary structure: a double claw at the tip, a double steelyard-hook; and that is all.

I could wish that anatomy would show me the working of the muscles and nerves in those tarsi, in those legs more slender than threads, the action of the tendons that control the claws and keep them gripped for ten months, unwearied in waking and sleeping. If some dexterous scalpel should ever investigate this problem, I can recommend another, even more singular than that of the Empusa, the Bat and the bird. I refer to the attitude of certain Wasps and Bees during the night's rest.

An Ammophila with red fore-legs (*A. holosericea*)[1] is plentiful in my enclosure towards the end of August and selects a certain lavender-border for her dormitory. At dusk, especially after a stifling day, when a storm is brewing, I am sure to find the strange sleeper settled there. Never was more eccentric attitude adopted for a night's rest! The mandibles bite right into the lavender-stem. Its square shape supplies a firmer hold than a round stalk would do. With this one and only prop, the animal's

[1] Cf. *The Hunting Wasps:* chap. xiii.—*Translator's Note.*

body juts out stiffly, at full length, with legs folded. It forms a right angle with the supporting axis, so much so that the whole weight of the insect, which has turned itself into the arm of a lever, rests upon the mandibles.

The Ammophila sleeps extended in space by virtue of its mighty jaws. It takes an animal to think of a thing like that, which upsets all our preconceived ideas of repose. Should the threatening storm burst, should the stalk sway in the wind, the sleeper is not troubled by her swinging hammock; at most, she presses her fore-legs for a moment against the tossed mast. As soon as equilibrium is restored, the favourite posture, that of the horizontal lever, is resumed. Perhaps the mandibles, like the bird's toes, possess the faculty of gripping tighter in proportion to the rocking of the wind.

The Ammophila is not the only one to sleep in this singular position, which is copied by many others—Anthidia,[1] Odyneri,[2] Euceræ [3]—and mainly by the males. All

[1] Cotton-bees. Cf. *Bramble-bees and Others:* chap. ix. —*Translator's Note.*

[2] A genus of Mason-wasps, the essay on whom has not yet been translated into English.—*Translator's Note.*

[3] A species of Burrowing Bees.—*Translator's Note.*

grip a stalk with their mandibles and sleep with their bodies outstretched and their legs folded back. Some, the stouter species, allow themselves to rest the tip of their arched abdomen against the pole.

This visit to the dormitory of certain Wasps and Bees does not explain the problem of the Empusa; it sets up another one, no less difficult. It shows us how deficient we are in insight, when it comes to differentiating between fatigue and rest in the cogs of the animal machine. The Ammophila, with the static paradox afforded by her mandibles; the Empusa, with her claws unwearied by ten months' hanging, leave the physiologist perplexed and make him wonder what really constitutes rest. In absolute fact, there is no rest, apart from that which puts an end to life. The struggle never ceases; some muscle is always toiling, some nerve straining. Sleep, which resembles a return to the peace of non-existence, is, like waking, an effort, here of the leg, of the curled tail; there of the claw, of the jaws.

The transformation is effected about the middle of May and the adult Empusa makes her appearance. She is even more remarkable in figure and attire than the Praying

Mantis. Of her youthful eccentricities, she retains the pointed mitre, the saw-like arm-guards, the long bust, the knee-pieces, the three rows of scales on the lower surface of the belly; but the abdomen is now no longer twisted into a crook and the animal is comelier to look upon. Large pale-green wings, pink at the shoulder and swift in flight in both sexes, cover the belly, which is striped white and green underneath. The male, the dandy sex, adorns himself with plumed antennæ, like those of certain Moths, the Bombyx tribe. In respect of size, he is almost the equal of his mate.

Save for a few slight structural details, the Empusa is the Praying Mantis. The peasant confuses them. When, in spring, he meets the mitred insect, he thinks he sees the common *Prègo-Diéu,* who is a daughter of the autumn. Similar forms would seem to indicate similarity of habits. In fact, led away by the extraordinary armour, we should be tempted to attribute to the Empusa a mode of life even more atrocious than that of the Mantis. I myself thought so at first; and any one, relying upon false analogies, would think the same. It is a fresh error: for all her warlike aspect, the

Empusa is a peaceful creature that hardly repays the trouble of rearing.

Installed under the gauze bell, whether in assemblies of half-a-dozen or in separate couples, she at no time loses her placidity. Like the larva, she is very abstemious and contents herself with a Fly or two as her daily ration.

Big eaters are naturally quarrelsome. The Mantis, bloated with Locusts, soon becomes irritated and shows fight. The Empusa, with her frugal meals, does not indulge in hostile demonstrations. There is no strife among neighbours nor any of those sudden unfurlings of the wings so dear to the Mantis when she assumes the spectral attitude and puffs like a startled Adder; never the least inclination for those cannibal banquets whereat the sister who has been worsted in the fight is devoured. Such atrocities are here unknown.

Unknown also are tragic nuptials. The male is enterprising and assiduous and is subjected to a long trial before succeeding. For days and days, he worries his mate, who ends by yielding. Due decorum is preserved after the wedding. The feathered groom retires, respected by his bride, and does his little bit

of hunting, without danger of being apprehended and gobbled up.

The two sexes live together in peace and mutual indifference until the middle of July. Then the male, grown old and decrepit, takes counsel with himself, hunts no more, becomes shaky in his walk, creeps down from the lofty heights of the trellised dome and at last collapses on the ground. His end comes by a natural death. And remember that the other, the male of the Praying Mantis, ends in the stomach of his gluttonous spouse.

The laying follows close upon the disappearance of the males. The Empusa, when about to build her nest, has not the round belly of the Praying Mantis, rendered heavy and inactive by her fertility. Her slender figure, still capable of flight, announces a scanty progeny. Her nest, fixed upon a straw, a twig, a chip of stone, is quite as small a structure as that of the dwarf Mantis (*Ameles decolor*) and measures two-fifths of an inch, at most, in length. The general shape is that of a trapezoid, of which the shorter sides are, respectively, sloping and slightly convex. As a rule, the sloping side is surmounted by a thread-like appendage, similar to the final spur of the nests of the

Mantis and the Ameles, but finer in appearance. This is the last drop of viscous matter, dried and drawn out. Builders, when their work is finished, crown the edifice with a green bough and coloured streamers. In much the same way, the Mantis tribe set up a mast on the completed nest.

A very thin grey-wash, formed of dried foam, covers the Empusa's work, especially on the upper surface. Under this delicate glaze, which is easily rubbed off, the fundamental substance appears, homogeneous, horny, pale-red. Six or seven hardly-perceptible furrows divide the sides into curved sections.

After the hatching, a dozen round orifices open on the top of the building, in two alternate rows. These are the exit-doors for the young larvæ. The slightly projecting rim is continued from each aperture to the next in a sort of ribbon with a double row of alternating loops. It is obvious that the windings of this ribbon are the result of an oscillating movement of the ovipositor in labour. Those exit-holes, so regular in shape and arrangement, completed by the lateral ribs of the nest, present the appearance of two dainty mouth-organs placed in

juxtaposition. Each of them corresponds with a cell containing two eggs. The eggs in all, therefore, amount to about a couple of dozen.

I have not seen the hatching. I do not know whether, as in the Praying Mantis, it is preceded by a transition-stage adapted to facilitate the delivery. It may easily be that there is nothing of the kind, since everything is so well-prepared for the exit. Above the cells is a very short exit-hall, free of any obstacle. It is closed merely by a small quantity of frothy, crumbly matter, which will readily yield to the mandibles of the new-born larvæ. With this wide passage leading to the outer air, long legs and slender antennæ cease to be embarrassing appendages; and the tiny creature might well have the free use of them from the moment of leaving the egg, without going through the primary larval stage. Not having seen for myself, I merely mention the probable course of things.

One word more on comparative manners. The Mantis goes in for battle and cannibalism; the Empusa is peaceable and respects her kind. To what cause are these profound moral differences due, when the organic

structure is the same? Perhaps to the difference of diet. Frugality, in fact, softens character, in animals as in men; gross feeding brutalizes it. The gormandizer gorged with meat and strong drink, a fruitful source of savage outbursts, could not possess the gentleness of the ascetic who dips his bread into a cup of milk. The Mantis is that gormandizer, the Empusa that ascetic.

Granted. But whence does the one derive her voracious appetite, the other her temperate ways, when it would seem as though their almost identical structure ought to produce an identity of needs? These insects tell us, in their fashion, what many have already told us: that propensities and aptitudes do not depend exclusively upon anatomy; high above the physical laws that govern matter rise other laws that govern instincts.

CHAPTER XI

THE WHITE-FACED DECTICUS: HIS HABITS

THE White-faced Decticus (*D. albifrons*, FABR.) stands at the head of the Grasshopper clan in my district, both as a singer and as an insect of imposing presence. He has a grey costume, a pair of powerful mandibles and a broad ivory face. Without being plentiful, he does not let himself be sought in vain. In the height of summer we find him hopping in the long grass, especially at the foot of the sunny rocks where the turpentine-tree takes root.

At the end of July I start a Decticus-menagerie. As a vivarium I adopt a big wire-gauze cover standing on a bed of sifted earth. The population numbers a dozen; and both sexes are equally represented.

The question of victuals perplexes me for some time. It seems as though the regulation diet ought to be a vegetable one, to judge by the Locust, who consumes any

green thing. I therefore offer my captives the tastiest and tenderest garden-stuff that my enclosure holds: leaves of lettuce, chicory and corn-salad. The Dectici scarcely touch it with a contemptuous tooth. It is not the food for them.

Perhaps something tough would suit their strong mandibles better. I try various Graminaceæ, including the glaucous panic-grass, the *miauco* of the Provençal peasant, the *Setaria glauca* of the botanists, a weed that infests the fields after the harvest. The panic-grass is accepted by the hungry ones, but it is not the leaves that they devour: they attack only the ears, of which they crunch the still tender seeds with visible satisfaction. The food is found, at least for the time being. We shall see later.

In the morning, when the rays of the sun visit the cage placed in the window of my study, I serve out the day's ration, a sheaf of green spikes of common grass picked outside my door. The Dectici come running up to the handful, gather round it and, very peaceably, without quarrelling among themselves, dig with their mandibles between the bristles of the spikes to extract and nibble the unripe seeds. Their costume makes one

think of a flock of Guinea-fowl pecking the grain scattered by the farmer's wife. When the spikes are robbed of their tender seeds, the rest is scorned, however urgent the claims of hunger may be.

To break the monotony of the diet as much as is possible in these dog-days, when everything is burnt up, I gather a thick-leaved, fleshy plant which is not too sensitive to the summer heat. This is the common purslane, another invader of our garden-beds. The new green stuff meets with a good reception; and once again the Dectici dig their teeth not into the leaves and the juicy stalks, but only into the swollen capsules of half-formed grains.

This taste for tender seeds surprises me: *δηκτικός*, biting, fond of biting, the lexicon tells us. A name that expresses nothing, a mere identification-number, is able to satisfy the nomenclator; in my opinion, if the name possesses a characteristic meaning and at the same time sounds well, it is all the better for it. Such is the case here. The Decticus is eminently an insect given to biting. Mind your finger if the sturdy Grasshopper gets hold of it: he will rip it till the blood comes.

And can this powerful jaw, of which I

have to beware when I handle the creature, possess no other function than to chew soft grains? Can a mill like this have only to grind little unripe seeds? Something has escaped me. So well-armed with mandibular pincers, so well-endowed with masticatory muscles that swell out his cheeks, the Decticus must cut up some leathery prey.

This time I find the real diet, the fundamental if not the exclusive one. Some good-sized Locusts are let into the cage. I put in it the species mentioned in a note below,[1] now one, now the other, as they happen to get caught in my net. A few Grasshoppers [2] are also accepted, but not so readily. There is every reason to think that, if I had had the luck to capture them, the entire Locust and Grasshopper family would have met the same fate, provided that they were not too insignificant in size.

Any fresh meat tasting of Locust or Grasshopper suits my ogres. The most frequent victim is the Blue-winged Locust.

[1] *Œdipoda cærulescens*, LIN.; *Œ. miniata*, PALLAS; *Sphingonotus cærulans*, LIN.; *Caloptenus italicus*, LIN.; *Pachytylus nigrofasciatus*, DE GEER; *Truxalis nasuta*, LIN.—*Author's Note.*

[2] *Conocephalus mandibularis*, CHARP.; *Platycleis intermedia*, SERV.; *Ephippigea vitium*, SERV.—*Author's Note.*

The White-faced Decticus: his Habits

There is a deplorably large consumption of this species in the cage. This is how things happen: as soon as the game is introduced, an uproar ensues in the mess-room, especially if the Dectici have been fasting for some time. They stamp about and, hampered by their long shanks, dart forward clumsily; the Locusts make desperate bounds, rush to the top of the cage and there hang on, out of the reach of the Grasshopper, who is too stout to climb so high. Some are seized at once, as soon as they enter. The others, who have taken refuge up in the dome, are only postponing for a little while the fate that awaits them. Their turn will come; and that soon. Either because they are tired or because they are tempted by the green stuff below, they will come down; and the Dectici will be after them immediately.

Speared by the hunter's fore-legs, the game is first wounded in the neck. It is always there, behind the head, that the Locust's shell cracks first of all; it is always there that the Decticus probes persistently before releasing his hold and taking his subsequent meals off whatever joint he chooses.

It is a very judicious bite. The Locust is hard to kill. Even when beheaded, he goes

on hopping. I have seen some who, though half-eaten, kick out desperately and succeed, with a supreme effort, in releasing themselves and jumping away. In the brushwood, that would be so much game lost.

The Decticus seems to know all about it. To overcome his prey, so prompt to escape by means of its two powerful levers, and to render it helpless as quickly as possible, he first munches and extirpates the cervical ganglia, the main seat of innervation. Is this an accident, in which the assassin's choice plays no part? No, for I see the murder performed invariably in the same way when the prey is in possession of its full strength; and again no, because, when the Locust is offered in the form of a fresh corpse, or when he is weak, dying, incapable of defence, the attack is made anywhere, at the first spot that presents itself to the assailant's jaws. In such cases the Decticus begins either with a haunch, the favourite morsel, or with the belly, back or chest. The preliminary bite in the neck is reserved for difficult occasions.

This Grasshopper, therefore, despite his dull intellect, possesses the art of killing scientifically of which we have seen so many

instances elsewhere;[1] but with him it is a rude art, falling within the knacker's rather than the anatomist's domain.

Two or three Blue-winged Locusts are none too many for a Decticus' daily ration. It all goes down, save the wings and wing-cases, which are disdained as too tough. In addition, there is a snack of tender millet-grains stolen every now and again to make a change from the banquet of game. They are big eaters, are my boarders; they surprise me with their gormandizing and even more with their easy change from an animal to a vegetable diet.

With their accommodating and anything but particular stomachs, they could render some slight service to agriculture, if there were more of them. They destroy the Locusts, many of whom, even in our fields, are of ill fame; and they nibble, amid the unripe corn, the seeds of a number of plants which are obnoxious to the husbandman.

But the Decticus' claim to the honours of the vivarium rests upon something much better than his feeble assistance in preserving the fruits of the earth: in his song, his nup-

[1] Cf. *The Life of the Spider* and *The Hunting Wasps: passim.—Translator's Note.*

tials and his habits we have a memorial of the remotest times.

How did the insect's ancestors live, in the palæozoic age? They had their crude and uncouth side, banished from the better-proportioned fauna of to-day; we catch a vague glimpse of habits now almost out of use. It is unfortunate for our curiosity that the fossil remains are silent on this magnificent subject.

Luckily we have one resource left, that of consulting the successors of the prehistoric insects. There is reason to believe that the Locustids [1] of our own period have retained an echo of the ancient customs and can tell us something of the manners of olden time. Let us begin by questioning the Decticus.

In the vivarium the sated herd are lying on their bellies in the sun and blissfully digesting their food, giving no other sign of life than a gentle swaying of the antennæ. It is the hour of the after-dinner nap, the hour of enervating heat. From time to time a male gets up, strolls solemnly about, raises his wing-cases slightly and utters an occa-

[1] An orthopterous family which includes the Grasshoppers, but not the Locusts. The latter are Acridians. —*Translator's Note.*

sional *tick-tick*. Then he becomes more animated, hurries the pace of his tune and ends by grinding out the finest piece in his repertoire.

Is he celebrating his wedding? Is his song an epithalamium? I will make no such statement, for his success is poor if he is really making an appeal to his fair neighbours. Not one of his group of hearers gives a sign of attention. Not a female stirs, not one moves from her comfortable place in the sun. Sometimes the solo becomes a concerted piece sung by two or three in chorus. The multiple invitation succeeds no better. True, their impassive ivory faces give no indication of their real feelings. If the suitors' ditty indeed exercises any sort of seduction, no outward sign betrays the fact.

According to all appearances, the clicking is addressed to heedless ears. It rises in a passionate crescendo until it becomes a continuous rattle. It ceases when the sun vanishes behind a cloud and starts afresh when the sun shows itself again; but it leaves the ladies indifferent.

She who was lying with her shanks outstretched on the blazing sand does not change her position; her antennary threads

give not a quiver more and not a quiver less; she who was gnawing the remains of a Locust does not let go the morsel, does not lose a mouthful. To look at those heartless ones, you would really say that the singer was making a noise for the mere pleasure of feeling himself alive.

It is a very different matter when, towards the end of August, I witness the start of the wedding. The couple finds itself standing face to face quite casually, without any lyrical prelude whatever. Motionless, as though turned to stone, with their foreheads almost touching, the two exchange caresses with their long antennæ, fine as hairs. The male seems somewhat preoccupied. He washes his tarsi; with the tips of his mandibles he tickles the soles of his feet. From time to time he gives a stroke of the bow: *tick;* no more.

Yet one would think that this was the very moment at which to make the most of his strong points. Why not declare his flame in a fond couplet, instead of standing there, scratching his feet? Not a bit of it. He remains silent in front of the coveted bride, herself impassive.

The interview, a mere exchange of greet-

ings between friends of different sexes, does not last long. What do they say to each other, forehead to forehead? Not much, apparently, for soon they separate with nothing further; and each goes his way where he pleases.

Next day, the same two meet again. This time, the song, though still very brief, is in a louder key than on the day before, while being still very far from the burst of sound to which the Decticus will give utterance long before the pairing. For the rest, it is a repetition of what I saw yesterday: mutual caresses with the antennæ, which limply pat the well-rounded sides.

The male does not seem greatly enraptured. He again nibbles his foot and seems to be reflecting. Alluring though the enterprise may be, it is perhaps not unattended with danger. Can there be a nuptial tragedy here, similar to that which the Praying Mantis has shown us? Can the business be exceptionally grave? Have patience and you shall see. For the moment, nothing more happens.

A few days later, a little light is thrown upon the subject. The male is underneath, lying flat on the sand and towered over by

his powerful spouse, who, with her sabre exposed, standing high on her hind-legs, overwhelms him with her embrace. No, indeed: in this posture the poor Decticus has nothing of the victor about him! The other, brutally, without respecting the musical-box, is forcing open his wing-cases and nibbling his flesh just where the belly begins.

Which of the two takes the initiative here? Have not the parts been reversed? She who is usually provoked is now the provoker, employing rude caresses capable of carrying off the morsel touched. She has not yielded to him; she has thrust herself upon him, disturbingly, imperiously. He, lying flat on the ground, quivers and starts, seems trying to resist. What outrageous thing is about to happen? I shall not know to-day. The floored male releases himself and runs away.

But this time, at last, we have it. Master Decticus is on the ground, tumbled over on his back. Hoisted to the full height of her shanks, the other, holding her sabre almost perpendicular, covers her prostrate mate from a distance. The two ventral extremities curve into a hook, seek each other, meet; and soon from the male's convulsive loins there

is seen to issue, in painful labour, something monstrous and unheard-of, as though the creature were expelling its entrails in a lump.

It is an opalescent bag, similar in size and colour to a mistletoe-berry, a bag with four pockets marked off by faint grooves, two larger ones above and two smaller ones below. In certain cases the number of cells increases and the whole assumes the appearance of a packet of eggs such as *Helix aspersa,* the Common Snail, lays in the ground.

The strange concern remains hanging from the lower end of the sabre of the future mother, who solemnly retires with the extraordinary wallet, the spermatophore, as the physiologists call it, the source of life for the ovules, in other words the cruet which will now in due course transmit to the proper place the necessary complement for the evolution of the germs.

A capsule of this kind is a rare, an infinitely rare thing in the world of to-day. So far as I know, the Cephalopods [1] and the Scolopendras [2] are, in our time, the only

[1] The class of molluscs containing the Squids, Cuttle-fish, Octopus, etc.—*Translator's Note.*

[2] A genus of Myriapods including the typical Centipedes.—*Translator's Note.*

other animals that make use of the queer apparatus. Now Octopuses and Millepedes date back to the earliest ages. The Decticus, another representative of the old world, seems to tell us that what is a curious exception now might well have been a more or less general rule originally, all the more so as we shall come upon similar incidents in the case of the other Grasshoppers.

When the male has recovered from his shock, he shakes the dust off himself and once more begins his merry click-clack. For the present let us leave him to his joys and follow the mother that is to be, pacing along solemnly with her burden, which is fastened with a plug of jelly as transparent as glass.

At intervals she draws herself up on her shanks, curls into a ring and seizes her opalescent load in her mandibles, nibbling it calmly and squeezing it, but without tearing the wrapper or shedding any of the contents. Each time, she removes from the surface a particle which she chews and then chews again slowly, ending by swallowing it.

This process is continued for twenty minutes or so. Then the capsule, now drained, is torn off in a single piece, all but the jelly plug at the end. The huge, sticky

mass is not let go for a moment, but is munched, ground and kneaded by the insect's mandibles and at last gulped down whole.

At first I looked upon the horrible banquet as no more than an individual aberration, an accident: the Decticus' behaviour was so extraordinary; no other instance of it was known to me. But I have had to yield to the evidence of the facts. Four times in succession I surprised my captives dragging their wallet and four times I saw them soon tear it, work at it solemnly with their mandibles for hours on end and finally gulp it down. It is therefore the rule: when its contents have reached their destination, the fertilizing capsule, possibly a powerful stimulant, an unparalleled dainty, is chewed, enjoyed and swallowed.

If this, as we are entitled to believe, is a relic of ancient manners, we must admit that the insect of old had singular customs. Réaumur tells us of the startling operations of the Dragon-flies when pairing. This again is a nuptial eccentricity of primeval times.

When the Decticus has finished her strange feast, the end of the apparatus still remains in its place, the end whose most visible

part consists of two crystalline nipples the size of pepper-corns. To rid itself of this plug, the insect assumes a curious attitude. The ovipositor is driven half-way into the earth, perpendicularly. That will be the prop. The long hind-legs straighten out, raise the creature as high as possible and form a tripod with the sabre.

Then the insect again curves itself into a complete circle and, with its mandibles, crumbles to atoms the end of the apparatus, consisting of a plug of clearest jelly. All these remnants are scrupulously swallowed. Not a scrap must be lost. Lastly, the ovipositor is washed, wiped, smoothed with the tips of the palpi. Everything is put in order again; nothing remains of the cumbrous load. The normal pose is resumed and the Decticus goes back to pilfering the ears of millet.

To return to the male. Limp and exhausted, as though shattered by his exploit, he remains where he is, all shrivelled and shrunk. He is so motionless that I believe him dead. Not a bit of it! The gallant fellow recovers his spirits, picks himself up, polishes himself and goes off. A quarter of an hour later, when he has taken a few mouth-

fuls, behold him stridulating once more. The tune is certainly lacking in spirit. It is far from being as brilliant or prolonged as it was before the wedding; but, after all, the poor old crock is doing his best.

Can he have any further amorous pretensions? It is hardly likely. Affairs of that kind, calling for ruinous expenditure, are not to be repeated: it would be too much for the works of the organism. Nevertheless, next day and every day after, when a diet of Locusts has duly renewed his strength, the Decticus scrapes his bow as noisily as ever. He might be a novice, instead of a glutted veteran. His persistence surprises me.

If he be really singing to attract the attention of his fair neighbours, what would he do with a second wife, he who has just extracted from his paunch a monstrous wallet in which all life's savings were accumulated? He is thoroughly used up. No, once more, in the big Grasshopper these things are too costly to be done all over again. To-day's song, despite its gladness, is certainly no epithalamium.

And, if you watch him closely, you will see that the singer no longer responds to the

teasing of the passers' antennæ. The ditties become fainter from day to day and occur less frequently. In a fortnight the insect is dumb. The dulcimer no longer sounds, for lack of vigour in the player.

At last the decrepit Decticus, who now scarcely touches food, seeks a peaceful retreat, sinks to the ground exhausted, stretches out his shanks in a last throe and dies. As it happens, the widow passes that way, sees the deceased and, breathing eternal remembrance, gnaws off one of his thighs.

The Green Grasshopper behaves similarly. A couple isolated in a cage are subjected to a special watch. I am present at the end of the pairing, when the future mother is carrying, fixed to the point of her sword, the pretty raspberry which will occupy our attention later.[1] Debilitated by recent happenings, the male at this moment is mute. Next day, his strength returns; and you hear him singing as ardently as ever. He stridulates while the mother is scattering her eggs over the ground; he goes on making a noise long after the laying is done and when nothing more is wanted to perpetuate the race.

[1] Cf. Chapter XIV. of the present volume.—*Translator's Note.*

It is quite clear that this persistent singing has not an amorous appeal for its object: by this time, all of that is over, quite over. Lastly, one day or another, life fails and the instrument is dumb. The eager singer is no more. The survivor gives him a funeral copied from that of the Decticus: she devours the best bits of him. She loved him so much that she had to eat him up.

These cannibal habits recur in most of the Grasshopper tribe, without however equalling the atrocities of the Praying Mantis, who treats her lovers as dead game while they are still full of life. The Decticus mother, the Green Grasshopper and the rest at least wait until the poor wretches are dead.

I will except the Ephippiger, who is so meek in appearance. In my cage, when laying-time is at hand, she has no scruples about taking a bite at her companions, without possessing the excuse of hunger. Most of the males end in this lamentable fashion, half-devoured. The mutilated victim protests; he would rather, he could indeed go on living. Having no other means of defence, he produces with his bow a few grating sounds which this time decidedly are not a nuptial song. Dying with a great hole in his belly, he utters his

plaint in a like manner as though he were rejoicing in the sun. His instrument strikes the same note whether it express sorrow or gladness.

CHAPTER XII

THE WHITE-FACED DECTICUS: THE LAYING AND THE HATCHING OF THE EGGS

THE White-faced Decticus is an African insect that in France hardly ventures beyond the borders of Provence and Languedoc. She wants the sun that ripens the olives. Can it be that a high temperature acts as a stimulus to her matrimonial eccentricities, or are we to look upon these as family customs, independent of climate? Do things happen under frosty skies just as they do under a burning sun?

I go for my information to another Decticus, the Alpine Analota (*A. alpina*, YERSIN), who inhabits the high ridges of Mont Ventoux,[1] which are covered with snow for half the year. Many a time, during my old botanical expeditions, I had noticed the

[1] The highest mountain (6,270 feet) in the neighbourhood of Sérignan. Cf. *The Hunting Wasps:* chap. xi.—*Translator's Note.*

portly insect hopping among the stones from one bit of turf to the next. This time, I do not go in search of it: it reaches me by post. Following my indications, an obliging forester[1] climbs up there twice in the first fortnight of August and brings me back the wherewithal to fill a cage comfortably.

In shape and colouring it is a curious specimen of the Grasshopper family. Satin-white underneath, it has the upper part sometimes olive-black, sometimes bright-green or pale-brown. The organs of flight are reduced to mere vestiges. The female has as wing-cases two short white scales, some distance apart; the male shelters under the edge of his corselet two little concave plates, also white, but laid one on top of the other, the left on the right.

These two tiny cupolas, with bow and sounding-board, rather suggest, on a smaller scale, the musical instrument of the Ephippiger, whom the mountain insect resembles to some extent in general appearance.

I do not know what sort of tune cymbals so small as these can produce. I do not remember ever hearing them in their native

[1] M. Bellot, forest-ranger of Beaumont (Vaucluse).—*Author's Note.*

haunts; and three months' home breeding gives me no further information in this respect. Though they lead a joyous life, my captives are always dumb.

The exiles do not seem greatly to regret their cold peaks, among the orange poppies and saxifrages of arctic climes. What used they to browse upon up there? The Alpine meadow-grass, Mont-Cenis violets, Allioni's bell-flower? I do not know. In the absence of Alpine grasses, I give them the common endive from my garden. They accept it without hesitation.

They also accept such Locusts as can offer only a feeble resistance; and the diet alternates between animal and vegetable fare. They even practise cannibalism. If one of my Alpine visitors limps and drags a leg, the others eat him up. So far I have seen nothing striking: these are the usual Grasshopper manners.

The interesting sight is the pairing, which occurs suddenly, without any prelude. The meeting takes place sometimes on the ground, sometimes on the wirework of the cage. In the latter case, the sword-bearer, firmly hooked to the trellis, supports the whole weight of the couple. The other is back

downwards, his head pointing to his mate's tail. With his long, fleshy-shanked hind-legs, he gets a grip of her sides; with his four front legs, often also with his mandibles, he grasps and squeezes the sabre, which projects slantwise. Thus hanging to this sort of greased pole, he operates in space.

When the meeting takes place on the ground, the couple occupy the same position, only the male is lying on his back in the sand. In both cases the result is an opal grain which, in the visible part of it, resembles in shape and size the swollen end of a grape-pip.

As soon as this object is in position, the male decamps at full speed. Can he be in danger? Possibly, to judge from what I have seen. I admit that I have seen it only once.

The bride in this case was grappling with two rivals. One of them, hanging to the sabre, was at work in due form behind; the other, in front, tightly clawed and with his belly ripped open, was waving his limbs in vain protest against the harpy crunching him impassively in small mouthfuls. I had before my eyes, under even more atrocious conditions, the horrors which the Praying Mantis had shown me in the old days: unbridled

rut; carnage and voluptuousness in one; a reminiscence perhaps of ancient savagery.

As a rule, the male, a dwarf by comparison with the female, hastens to run away as soon as his task is consummated. The deserted one makes no movement. Then, after waiting twenty minutes or so, she curves herself into a ring and proceeds to enjoy the final banquet. She pulls the sticky raisin-pip into shreds which are chewed with grave appreciation and then gulped down. It takes her more than an hour to swallow the thing. When not a crumb remains, she descends from the wire gauze and mingles with the herd. Her eggs will be laid in a day or two.

The proof is established. The matrimonial habits of the White-faced Decticus are not an exception due to the heat of the climate: the Grasshopper from the cold peaks shares them and surpasses them.

We will return to the big Decticus with the ivory face. The laying follows close upon the strange events which we have described. It is done piecemeal, as the ovaries ripen. Firmly planted on her six legs, the mother bends her abdomen into a semicircle and drives her sabre perpendicularly into the

soil, which, consisting in my cages of sifted earth, presents no serious resistance. The ovipositor therefore descends without hesitation and enters up to the hilt, that is to say, to a depth of about an inch.

For nearly fifteen minutes, absolute immobility. This is the time when the eggs are being laid. At last the sabre comes up a little way and the abdomen swings briskly from side to side, communicating an alternate transversal movement to the implement. This tends to scrape out and widen the sunken hole; it also has the effect of releasing from the walls earthy materials which fill up the bottom of the cavity. Thereupon the ovipositor, which is half in and half out, rams down this dust. It comes up a short distance and then dips repeatedly, with a sudden, jerky movement. We should work in the same way with a stick to ram down the earth in a perpendicular hole. Thus alternating the transversal swing of the sabre with the blows of the rammer, the mother covers up the well pretty quickly.

The external traces of the work have still to be done away with. The insect's legs, which I expected to see brought into play, remain inactive and keep the position

adopted for laying the eggs. The sabre alone scratches, sweeps and smooths the ground with its point, very clumsily, it must be admitted.

Now all is in order. The abdomen and the ovipositor are restored to their normal positions. The mother allows herself a moment's rest and goes to take a turn in the neighbourhood. Soon she comes back to the site where she has already laid her eggs and, very near the original spot, which she recognizes clearly, she drives in her tool afresh. The same proceedings as before are repeated.

Follow another rest, another exploration of the vicinity, another return to the place already sown. For the third time the pointed stake descends, only a very slight distance away from the previous hole. During the brief hour that I am watching her, I see her resume her laying five times, after breaking off to take a little stroll in the neighbourhood; and the points selected are always very close together.

On the following days, at varying intervals, the sowing is renewed for a certain number of times which I am not able to state exactly. In the case of each of these partial

layings, the site changes, now here, now there, as this or that spot is deemed the more propitious.

When everything is finished, I examine the little pits in which the Decticus placed her eggs. There are no packets in a foamy sheath, such as the Locust supplies; no cells either. The eggs lie singly, without any protection. I gather three score as the total product of one mother. They are of a pale lilac-grey and are drawn out shuttlewise, in a narrow ellipsoid five or six millimetres long.[1]

The same isolation marks those of the Grey Decticus, which are black; those of the Vine Ephippiger, which are ashen-grey; and those of the Alpine Analota, which are pale-lilac. The eggs of the Green Grasshopper, which are a very dark olive-brown and, like those of the White-faced Decticus, about sixty in number, are sometimes arranged singly and sometimes stuck together in little clusters.

These different examples show us that the Grasshoppers plant with a dibble. Instead of packing their seeds in little casks of hardened foam, like the Locusts, they put

[1] .195 to .234 inch.—*Translator's Note.*

them into the earth one by one or in very small clusters.

The hatching is worth examination; I will explain why presently. I therefore gather plenty of eggs of the big Decticus at the end of August and place them in a small glass jar with a layer of sand. Without undergoing any apparent modification, they spend eight months here under cover, sheltered from the frosts, the showers and the overpowering heat of the sun that would await them under natural conditions.

When June comes, I often meet young Dectici in the fields. Some are already half their adult size, which is evidence of an early appearance dating back to the first fine days of the year. Nevertheless my jar shows no signs of any imminent hatching. I find the eggs just as I gathered them nine months ago, neither wrinkled nor tarnished, wearing, on the contrary, a most healthy look. What causes this indefinitely prolonged delay?

A suspicion occurs to me. The eggs of the Grasshopper tribe are planted in the earth like seeds. They are there exposed, without any kind of protection, to the watery influence of the snow and the rain. Those

in my jar have spent two-thirds of the year in a state of comparative dryness. Perhaps, in order to hatch, they lack what grain absolutely needs in order to sprout. Animal seeds as they are, they may yet require under earth the moisture necessary to vegetable seeds. Let us try.

I place at the bottom of some glass tubes, to enable me to make certain observations which I have in mind, a pinch of backward eggs taken from my collection; and on the top I heap lightly a layer of very fine, damp sand. The receptacle is closed with a plug of wet cotton, which will maintain a constant moisture in the interior. The column of sand measures about an inch, which is very much the depth at which the ovipositor places the eggs. Any one seeing my preparations and unacquainted with their object would hardly suspect them of being incubators; he would be more likely to think them the apparatus of a botanist who was experimenting with seeds.

My anticipation was correct. Favoured by the high temperature of the summer solstice, the Grasshopper seed does not take long to sprout. The eggs swell; the front end of each is spotted with two dark dots,

the rudiments of the eyes. It is quite evident that the bursting of the shell is near at hand.

I spend a fortnight in keeping a tedious watch at every hour of the day: I have to surprise the young Decticus actually leaving the egg, if I want to solve a question that has long been vexing my mind. The question is this: the Grasshopper's egg is buried at a varying depth, according to the length of the ovipositor or dibble. An inch is about the most for the seeds of the best-equipped insects in our parts. Now the newborn Decticus, hopping awkwardly in the grass at the approach of summer, is, like the adult, endowed with a pair of very long tentacles, vying with hairs for slenderness; he carries behind him two extraordinary legs, two enormous hinged levers, a pair of jumping-stilts that would be very inconvenient for ordinary walking. How does the feeble little creature set to work, with this cumbrous luggage, to emerge from the earth? By what artifice does it manage to clear a passage through the rough soil? With its antennary plumes, which an atom of sand can break, with its immense shanks, which the least effort is enough to

disjoint, the mite is obviously incapable of reaching the surface and freeing itself.

The miner going underground puts on a protective dress. The little Grasshopper also, making a hole in the earth in the opposite direction, must don an overall for emerging from the earth; he must possess a simpler, more compact transition-form, which enables him to come out through the sand, a delivery-shape analogous to that which the Cicada and the Praying Mantis use at the moment of issuing, one from his twig, the other from the labyrinth of his nest.

Reality and logic here agree. The Decticus, in point of fact, does not leave the egg in the form in which I see him, the day after his birth, hopping on the lawn; he possesses a temporary structure better-suited to the difficulties of the emergence. Coloured a delicate flesh-white, the tiny creature is cased in a scabbard which keeps the six legs flattened against the abdomen, stretching backwards, inert. In order to slip more easily under the ground, he has his shanks tied up beside his body. The antennæ, those other irksome appendages, are motionless, pressed against the parcel.

The head is very much bent against the

chest. With its big, black ocular specks and its undecided and rather bloated mask, it suggests a diver's helmet. The neck opens wide at the back and, with a slow throbbing, by turns swells and subsides. That is the motor. The new-born insect moves along with the aid of its occipital hernia. When uninflated, the fore-part pushes back the damp sand a little way and slips into it by digging a tiny pit; then, blown out, it becomes a knob, which moulds itself and finds a support in the depression obtained. Then the rear-end contracts; and this gives a step forward. Each thrust of the locomotive blister means nearly a millimetre [1] traversed.

It is pitiful to see this budding flesh, scarcely tinged with pink, knocking with its dropsical neck and ramming the rough soil. The animal glair, not yet quite hardened, struggles painfully with stone; and its efforts are so well directed that, in the space of a morning, a gallery opens, either straight or winding, an inch long and as wide as an average straw. In this way the harassed insect reaches the surface.

Half-caught in its exit-shaft, the disinterred one halts, waits for its strength to

[1] .039 inch.—*Translator's Note.*

return and then for the last time swells its occipital hernia as far as it will go and bursts the sheath that has protected it so far. The creature throws off its miner's overall.

Here at last is the Decticus in his youthful shape, quite pale still, but darker the next day and a regular blackamoor compared with the adult. As a prelude to the ivory face of a riper age, he sports a narrow white stripe under his hinder thighs.

Little Decticus, hatched before my eyes, life opens for you very harshly! Many of your kindred must die of exhaustion before attaining their freedom. In my tubes I see numbers who, stopped by a grain of sand, succumb half-way and become furred with a sort of silky mildew. The mouldy part soon absorbs their poor little remains. When performed without my assistance, the coming to the light of day must be attended with even greater dangers. The usual soil is coarse and baked by the sun. Without a fall of rain, how do they manage, these immured ones?

More fortunate in my tubes with their sifted and wetted mould, here you are outside, you little white-striped nigger; you bite at the lettuce-leaf which I have given

you; you leap about gaily in the cage where I have housed you. It would be easy to rear you, I can see, but it would not give me much fresh information. Let us then part company. I restore you to liberty. In return for what you have taught me, I bestow upon you the grass and the Locusts in the garden.

Thanks to you, I know that Grasshoppers, in order to leave the ground in which the eggs are laid, possess a provisional shape, a primary larval stage, which keeps those too cumbrous parts, the long legs and antennæ, swathed in a common sheath; I know that this sort of mummy, fit only to lengthen and shorten itself a little, has for an organ of locomotion a hernia in the neck, a throbbing blister, an original piece of mechanism which I have never seen used elsewhere as an aid to progression.[1]

[1] This essay was written prior to that on the Grey Flesh-flies, who employ a similar method. Cf. *The Life of the Fly:* chap. x.—*Translator's Note.*

CHAPTER XIII

THE WHITE-FACED DECTICUS: THE INSTRUMENT OF SOUND

ART has three fields which it may cultivate in the realm of natural objects: form, colour and sound. The sculptor uses form and imitates its perfection in so far as the chisel is able to imitate life. The draughtsman, likewise a copyist, seeks in black and white to give the illusion of relief on a flat surface. To the difficulties of drawing the painter adds those of colour, which are no less great.

An inexhaustible model sits to all three. Rich though the painter's palette be, it will always be inferior to that of reality. Nor will the sculptor's chisel ever exhaust the treasures of the plastic art in nature. Form and colour, beauty of outline and play of light: these are all taught by the contemplation of actual things. They are imitated,

they are combined according to our tastes, but they are not invented.

On the other hand, our music has no prototype in the symphony of created things. Certainly there is no lack of sounds, faint or loud, sweet and solemn. The wind roaring through the storm-tossed woods, the waves curling and breaking on the beach, the thunder growling in the echoing clouds stir us with their majestic notes; the breeze filtering through the tiny foliage of the pine-trees, the Bees humming over the spring flowers charm every ear endowed with any delicacy; but these are monotonous noises, with no connection. Nature has superb sounds; she has no music.

Howling, braying, grunting, neighing, bellowing, bleating, yelping: these exhaust the phonetics of our near neighbours in organization. A musical score composed of such elements would be called a hullabaloo. Man, forming a striking exception at the top of the scale of these makers of raucous noises, took it into his head to sing. An attribute which no other shares with him, the attribute of coordinated sounds whence springs the incomparable gift of speech, led him on to scientific vocal exercises. In the absence

of a model, it must have been a laborious apprenticeship.

When our prehistoric ancestor, to celebrate his return from hunting the Mammoth, intoxicated himself with sour tipple brewed from raspberries and sloes, what can have issued from his hoarse larynx? An orthodox melody? Certainly not; hoarse shouts, rather, capable of shaking the roof of his cave. The loudness of the cry constituted its merit. The primitive song is found to this day when men's throats are fired in taverns instead of caverns.

And this tenor, with his crude vocal efforts, was already an adept at guiding his pointed flint to engrave on ivory the effigy of the monstrous animal which he had captured; he knew how to embellish his idol's cheeks with red chalk; he knew how to paint his own face with coloured grease. There were plenty of models for form and colour but none for rhythmic sounds.

With progress came the musical instrument, as an adjunct to those first guttural attempts. Men blew down tubes taken all in one piece from the sappy branches; they produced sounds from the barley-stalks and made whistles out of reeds. The shell of a

Snail, held between two fingers of the closed fist, imitated the Partridge's call; a trumpet formed of a wide strip of bark rolled into a horn reproduced the bellowing of the Bull; a few gut-strings stretched across the empty shell of a calabash grated out the first notes of our stringed instruments; a Goat's bladder, fixed on a solid frame, was the original drum; two flat pebbles struck together at measured intervals led the way for the click of the castagnettes. Such must have been the primitive musical materials, materials still preserved by the child, which, with its simplicity in things artistic, is so strongly reminiscent of the big child of yore.

Classical antiquity knew no others, as witness the shepherds of Theocritus and Virgil.

Silvestrem tenui musam meditaris avena,

says Meliboeus to Tityrus.[1]

[1] "Beneath the shade which beechen boughs diffuse,
You, Tityrus, entertain your sylvan muse.
. . . . . .
These blessings friend, a deity bestowed:
. . . . . .
He gave my kine to graze the flowery plain
And to my pipe renewed the rural strain."
—*Pastorals:* book i.; Dryden's translation.

What are we to make of this oat-straw, this frail shepherd's pipe, as they used to make us translate it in my young days? Did the poet write *avena tenui* by way of a rhetorical figure, or was he describing a reality? I vote for the reality, having myself in the old days heard a concert of shepherd's pipes.

It was in Corsica, at Ajaccio. In gratitude for a handful of sugar-plums, some small boys of the neighbourhood came one day and serenaded me. Quite unexpectedly, in gusts of untutored harmony, strange sounds of rare sweetness reached my ears. I ran to the window. There stood the orchestra, none taller than a jack-boot, gathered solemnly in a ring, with the leader in the middle. Most of them had at their lips a green onion-stem, distended spindlewise; others a stubble straw, a bit of reed not yet hardened by maturity.

They blew into these, or rather they sang a *vocero,* to a grave measure, perhaps a relic of the Greeks. Certainly, it was not music as we understand it; still less was it a meaningless noise; but it was a vague, undulating melody, abounding in artless irregularities, a medley of pretty sounds in which

the sibilations of the straw threw into relief the bleating of the swollen stalks. I stood amazed at the onion-stem symphony. Very much so must the shepherds of the eclogue have gone to work, *avena tenui;* very much so must the bridal epithalamium have been sung in the Reindeer period.

Yes, the simple melody of my Corsican youngsters, a real humming of Bees on the rosemaries, has left a lasting trace in my memory. I can hear it now. It taught me the value of the rustic pipes, once so constantly celebrated in a literature that is now old-fashioned. How far removed are we from those simple joys! To charm the populace in these days you need ophicleides, saxhorns, trombones, cornets, every imaginable sort of brass, with big drums and little drums and, to beat time, a gun-shot. That's what progress does.

Three-and-twenty centuries ago, Greece assembled at Delphi for the festivals of the sun, Phœbus with the golden locks. Thrilled with religious emotion she listened to the Hymn of Apollo, a melody of a few lines, barely supported here and there by a scanty chord on the flute and cithara. Hailed as a masterpiece, the sacred song was engraved

on marble tablets which the archæologists have recently exhumed.

The venerable strains, the oldest in musical records, have been heard in my time in the ancient theatre at Orange, a ruin in stone worthy of that ruin of sound. I was not present at the performance, being kept away by my habit of running to the west whenever there are fireworks in the east. One of my friends, a man gifted with a very sensitive ear, went; and he said to me afterwards:

"There were probably ten thousand people forming the audience in the enormous amphitheatre. I very much doubt whether one of them understood that music of another age. As for me, I felt as if I were listening to a blind man's plaintive ditty and I looked round involuntarily for the dog holding the cup."

The barbarian, to turn the Greek masterpiece into a stupid wail! Was it irreverence on his part? No, but it was incapacity. His ear, trained in accordance with other rules, was unable to take pleasure in artless sounds which had become strange and even disagreeable owing to their great age. What my friend lacked, what we all lack is the per-

ception of those primitive niceties which have been stifled by the centuries. To enjoy the Hymn to Apollo, we should have to go back to the simplicity of soul which one day made me think the buzzing of the onion-stalks delightful. And that we shall never do.

But, if our music need not draw its inspiration from the Delphic marbles, our statuary and our architecture will always find models of incomparable perfection in the work of the Greeks. The art of sounds, having no prototype imposed on it by natural facts, is liable to change: with our fickle tastes, that which is perfect in music to-day becomes vulgar and commonplace to-morrow. The art of forms, on the contrary, being based on the immutable foundation of reality, always sees the beautiful where previous centuries saw it.

There is no musical type anywhere, not even in the song of the Nightingale, celebrated by Buffon[1] in grandiloquent terms.

[1] Georges Louis Leclerc de Buffon (1707-1788), the foremost French naturalist and one of the foremost French writers, though his style, as Fabre rightly suggests, was nothing less than pompous. He was the originator, in the speech delivered at his reception into the French academy, of the famous aphorism, "*Le style est l'homme même.*"—*Translator's Note.*

I have no wish to shock anybody; but why should I not give my opinion? Buffon's style and the Nightingale's song both leave me cold. The first has too much rhetoric about it and not enough sincere emotion. The second, a magnificent jewel-case of ill-assorted pearls of sound, makes so slight an appeal to the soul that a penny jug, filled with water and furnished with a whistle, will enable the lips of a child to reproduce the celebrated songster's finest trills. A little earthenware machine, warbling at the player's will, rivals the Nightingale.

Above the bird, that glorious production of a vibrating air-column, creatures roar and bray and grunt, until we come to man, who alone speaks and really sings. Below the bird, they croak or are silent. The bellows of the lungs have two efflorescences separated by enormous empty spaces filled with formless sounds. Lower down still is the insect, which is much earlier in date. This first-born of the dwellers on the earth is also the first singer. Deprived of the breath which could set the vocal cords vibrating, it invents the bow and friction, of which man is later to make such wonderful use.

Various Beetles produce a noise by sliding

one rugged surface over another. The Capricorn moves his corseleted segment over its junction with the rest of the thorax; the Pine Cockchafer,[1] with his great fan-shaped antennæ, rubs his last dorsal segment with the edge of his wing-cases; the Copris[2] and many more know no other method. To tell the truth, these scrapers do not produce a musical sound, but rather a creaking like that of a weathercock on its rusty pin, a thin, sharp sound with no resonance in it.

Among these inexperienced scrapers, I will select the Bolboceras (*B. gallicus*, MULS.),[3] as deserving honourable mention. Round as a ball, sporting a horn on his forehead, like the Spanish Copris, whose stercoral tastes he does not share, this pretty Beetle loves the pine-woods in my neighbourhood and digs himself a burrow in the sand, leaving it in the evening twilight with the gentle chirp of a well-fed nestling under its mother's

[1] Cf. *Social Life in the Insect World*, by J. H. Fabre, translated by Bernard Miall: chap. xxi.—*Translator's Note.*

[2] A Dung-beetle. Cf. *The Life and Love of the Insect:* chap. v.—*Translator's Note.*

[3] Cf. *The Life of the Caterpillar*, by J. Henri Fabre, translated by Alexander Teixeira de Mattos: chap. xiii. —*Translator's Note.*

wing. Though habitually silent, he makes a noise at the least disturbance. A dozen of him imprisoned in a box will provide you with a delightful symphony, very faint, it is true: you have to hold the box close to your ear to hear it. Compared with him, the Capricorn, Copris, Pine Cockchafer and the rest are rustic fiddlers. In their case, after all, it is not singing, but rather an expression of fear, I might almost say, a cry of anguish, a moan. The insect utters it only in a moment of danger and never, so far as I know, at the time of its wedding.

The real musician, who expresses his gladness by strokes of the bow and cymbals, dates much farther back. He preceded the insects endowed with a superior organization, the Beetle, the Bee, the Fly, the Butterfly, who prove their higher rank by complete transformations; he is closely connected with the rude beginnings of the geological period. The singing insect, in fact, belongs exclusively either to the order of the Hemiptera, including the Cicadæ, or to that of the Orthoptera, including the Grasshoppers and Crickets. Its incomplete metamorphoses link it with those primitive races whose records are inscribed in our coal-seams. It

is one of the first that mingled the sounds of life with the vague murmuring of inert things. It was singing before the reptile had learnt to breathe.

This shows, from the mere point of view of sound, the futility of those theories of ours which try to explain the world by the automatic evolution of progress nascent in the primitive cell. All is yet dumb; and already the insect is stridulating as correctly as it does to-day. Phonetics start with an apparatus which the ages will hand down to one another without changing any essential part of it. Then, though the lungs have appeared, we have silence, save for the heavy breathing of the nostrils. But lo, one day, the Frog croaks; and soon, with no preparation, there are mingled with this hideous concert the trills of the Quail, the whistled stanzas of the Thrush and the Warbler's musical strains. The larynx in its highest form has come into existence. What will the late-comers do with it? The Ass and the Wild Boar give us our reply. We find something worse than marking time, we find an enormous retrogression, until one last bound brings us to man's own larynx.

In this genesis of sounds it is impossible to

talk authoritatively of a steady progression which makes the middling follow on the bad and the excellent on the middling. We see nothing but abrupt excursions, intermittences, recoils, sudden expansions not foretold by what has gone before nor continued by that which follows; we find nothing but a riddle whose solution does not lie in the virtues of the cell alone, that easy pillow for whoso has not the courage to search deeper.

But let us leave the question of origins, that inaccessible domain, and come down to facts; let us cross-examine a few representatives of those old races who were the earliest exponents of the art of sounds and took it into their heads to sing at a time when the mud of the first continents was hardening; let us ask them how their instrument is constructed and what is the object of their ditty.

The Grasshopper, so remarkable both for the length and thickness of her hinder thighs and for her ovipositor, the sabre or dibble which plants her eggs, is one of the chief performers in the entomological concert. Indeed, if we except the Cicada, who is often confused with her, she is responsible for the greater part of the noise. Only one of the Orthoptera surpasses her; and that is

the Cricket, her near neighbour. Let us first listen to the White-faced Decticus.

The performance begins with a hard, sharp, almost metallic sound, very like that emitted by the Thrush keeping a sharp look-out while he stuffs himself with olives. It consists of a series of isolated notes, *tick-tick,* with a longish pause between them. Then, with a gradual *crescendo,* the song develops into a rapid clicking in which the fundamental *tick-tick* is accompanied by a continuous droning bass. At the end the *crescendo* becomes so loud that the metallic note disappears and the sound is transformed into a mere rustle, a *frrrr-frrrr-frrrr* of the greatest rapidity.

The performer goes on like this for hours, with alternating strophes and rests. In calm weather, the song, at its height, can be heard twenty steps away. That is no great distance. The noise made by the Cicada and the Cricket carries much farther.

How are the strains produced? The books which I am able to consult leave me perplexed. They tell me of the "mirror," a thin, quivering membrane which glistens like a blade of mica; but how is this membrane made to vibrate? That is what they

either do not tell us or else tell us very vaguely and inaccurately, talking of a friction of the wing-cases, mutual rubbing of the nervures; and that is all.

I should like a more lucid explanation, for a Grasshopper's musical-box, I feel certain in advance, must have an exact mechanism of its own. Let us therefore look into the matter, even though we have to repeat observations already perhaps made by others, but unknown to a recluse like myself, whose whole library consists of a few old odd volumes.

The Decticus' wing-cases widen at the base and form on the insect's back a flat sunken surface shaped like an elongated triangle. This is the sounding-board. Here the left wing-case folds over the right and, when at rest, completely covers the latter's musical apparatus. The most distinct and, from time immemorial, the best-known part of it is the mirror, thus called because of the shininess of its thin oval membrane, set in the frame of a nervure. It is very like the skin of a drum, of an exquisitely delicate tympanum, with this difference, that it sounds without being tapped. Nothing touches the mirror when the Decticus sings. Its vibra-

tions are imparted to it after starting elsewhere. And how? I will tell you.

Its edging is prolonged at the inner angle of the base by a wide, blunt tooth, furnished at the end with a more prominent and powerful fold than the other nervures distributed here and there. I will call this fold the friction-nervure. This is the starting-point of the concussion that makes the mirror resound. The evidence will appear when the remainder of the apparatus is known.

This remainder, the motor mechanism, is on the left wing-case, covering the other with its flat edge. Outside, there is nothing remarkable, unless it be—and even then one has to be on the look-out for it—a sort of slightly slanting, transversal pad, which might very easily be taken for a thicker nervure than the others.

But examine the lower surface through the magnifying-glass. The pad is much more than an ordinary nervure. It is an instrument of the highest precision, a magnificent indented bow, marvellously regular on its diminutive scale. Never did human industry, when cutting metal for the most delicate clockwork mechanism, achieve such perfection. Its shape is that of a curved spindle.

From one end to the other there have been cut across this bow about eighty triangular teeth, which are very even and are of some hard, durable material, dark-brown in colour.

The use of this mechanical gem is obvious. If we take a dead Decticus and lift the flat rim of the two wing-cases slightly in order to place them in the position which they occupy when sounding, we see the bow fitting its indentations to the terminal nervure which I have called the friction-nervure; we follow the line of teeth which, from end to end of the row, never swerve from the points to be set in motion; and, if the operation be done at all dexterously, the dead insect sings, that is to say, strikes a few of its clicking notes.

The secret of the sounds produced by the Decticus is out. The toothed bow of the left wing-case is the motor; the friction-nervure of the right wing-case is the point of concussion; the stretched membrane of the mirror is the resonator, to which vibration is communicated by the shaking of the surrounding frame. Our own music has many vibrating membranes; but these are always affected by direct percussion. Bolder than

our makers of musical instruments, the Decticus combines the bow with the drum.

The same combination is found in the other Grasshoppers. The most famous of these is the Green Grasshopper (*Locusta viridissima,* LIN.), who to the qualities of a handsome stature and a fine green colour adds the honour of classical renown. In La Fontaine she is the Cicada who comes alms-begging of the Ant when the north wind blows. Flies and Grubs being scarce, the would-be borrower asks for a few grains to live upon until next summer. The double diet, animal and vegetable, is a very happy inspiration on the fabulist's part.

The Grasshopper, in fact, has the same tastes as the Decticus. In my cages, he feeds on lettuce-leaves when there is nothing better going; but his preference is all in favour of the Locust, whom he crunches up without leaving anything but the wing-cases and wings. In a state of liberty, his preying on that ravenous browser must largely make up to us for the small toll which he levies on our agricultural produce.

Except in a few details, his musical instrument is the same as that of the Decticus. It occupies, at the base of the wing-cases, a

large sunken surface shaped like a curved triangle and brownish in colour, with a dull-yellow rim. It is a sort of escutcheon, emblazoned with heraldic devices. On the under surface of the left wing-case, which is folded over the right, two transversal, parallel grooves are cut. The space between them makes a ridge which constitutes the bow. The latter, a brown spindle, has a set of fine, very regular and very numerous teeth. The mirror of the right wing-case is almost circular, well framed and supplied with a strong and prominent friction-nervure.

The insect stridulates in July and August, in the evening twilight, until close upon ten o'clock. It produces a quick, rattling noise, accompanied by a faint metallic clicking which barely passes the border of perceptible sounds. The abdomen, considerably lowered, throbs and beats the measure. This goes on for irregular periods and suddenly ceases; in between these periods there are false starts reduced to a few strokes of the bow; there are pauses and then the stridulation is once more in full swing.

All said, it is a very meagre performance, greatly inferior in volume to that of the Decticus, not to be compared with the song of

the Cricket and even less with the harsh and noisy efforts of the Cicada. In the quiet of the evening, when only a few steps away, I need little Paul's delicate ear to apprise me of it.

It is poorer still in the two dwarf Dectici of my neighbourhood, *Platycleis intermedia,* SERV., and *P. grisea,* FAB., both of whom are common in the long grass, where the ground is stony and exposed to the sun, and quick to disappear in the undergrowth when you try to catch them. These two fat songsters have each had the doubtful privilege of a place in my cages.

Here, in a blazing sun beating straight upon the window, are my little Dectici crammed with green millet-seeds and also with game. Most of them are lying in the hottest places, on their bellies or sides, with their hind-legs outstretched. For hours on end they digest without moving and slumber in their voluptuous attitude. Some of them sing. Oh, what a feeble song!

The ditty of the Intermediary Decticus, with its strophes and pauses alternating at equal intervals, is a rapid *fr-r-r-r* similar to the Coaltit's, while that of the Grey Decticus consists of distinct strokes of the bow and

tends to copy the Cricket's melody, with a note which is hoarser and, in particular, much fainter. In both cases, the feebleness of the sound hardly allows me to hear the singer a couple of yards away.

And to produce this music, this insignificant and only just perceptible refrain, the two dwarfs have all that their big cousin possesses: a toothed bow, a tambourine, a friction-nervure. On the bow of the Grey Decticus I count about forty teeth and eighty on that of the Intermediary Decticus. Moreover, in both, the right wing-case displays, around the mirror, a few diaphanous spaces, intended no doubt to increase the extent of the vibrating portion. It makes no difference: though the instrument is magnificent, the production of sound is very poor.

With this same mechanism of a drum and file, which of them will achieve any progress? Not one of the large-winged Locustidæ succeeds in doing so. All, from the biggest, the Grasshoppers, Dectici and Conocephali, down to the smallest, the Platycleis, Xiphidion and Phaneropteron, set in motion with the teeth of a bow the frame of a vibrating-mirror; all are, so to speak, left-handed, that is to say, they carry the bow on the lower

surface of the left wing-case, overlapping the right, which is furnished with the tympanum; all, lastly, have a thin, faint trill which is sometimes hardly perceptible.

One alone, modifying the details of the apparatus without introducing any innovation into the general structure, achieves a certain power of sound. This is the Vine Ephippiger, who does without wings and reduces his wing-cases to two concave scales, elegantly fluted and fitting one into the other. These two disks are all that remains of the organs of flight, which have become exclusively organs of song. The insect abandons flying to devote itself the better to stridulation.

It shelters its instrument under a sort of dome formed by the corselet, which is curved saddlewise. As usual, the left scale occupies the upper position and bears on its lower surface a file in which we can distinguish with the lens eighty transversal denticulations, more powerful and more clearly cut than those possessed by any other of the Grasshopper tribe. The right scale is underneath. At the top of its slightly flattened dome, the mirror gleams, framed in a strong nervure.

For elegance of structure, this instrument

is superior to the Cicada's, in which the contraction of two columns of muscles alternately pulls in and lets out the convex surface of two barren cymbals. It needs sound-chambers, resonators, to become a noisy apparatus. As things are, it emits a lingering and plaintive *tchi-i-i, tchi-i-i, tchi-i-i,* in a minor key, which is heard even farther than the blithe bowing of the White-faced Decticus.

When disturbed in their repose, the Decticus and the other Grasshoppers at once become silent, struck dumb with fear. With them, singing invariably expresses gladness. The Ephippiger also dreads to be disturbed and baffles with his sudden silence whoso seeks to find him. But take him between your fingers. Often he will resume his stridulation with erratic strokes of the bow. At such times the song denotes anything but happiness, fear rather and all the anguish of danger. The Cicada likewise rattles more shrilly than ever when a ruthless child dislocates his abdomen and forces open his chapels. In both cases, the gay refrain of the mirthful insect turns into the lamentation of a persecuted victim.

A second peculiarity of the Ephippiger's,

unknown to the other singing insects, is worthy of remark. Both sexes are endowed with the sound-producing apparatus. The female, who, in the other Grasshoppers, is always dumb, with not even a vestige of bow or mirror, acquires in this instance a musical instrument which is a close copy of the male's.

The left scale covers the right. Its edges are fluted with thick, pale nervures, forming a fine-meshed network; the centre, on the other hand, is smooth and swells into an amber-coloured dome. Underneath, this dome is supplied with two concurrent nervures, the chief of which is slightly wrinkled on its ridge. The right scale is similarly constructed, but for one detail: the central dome, which also is amber-coloured, is traversed by a nervure which describes a sort of sinuous line and which, under the magnifying-glass, reveals very fine transversal teeth throughout the greater part of its length.

This feature betrays the bow, placed in the inverse position to that which is known to us. The male is left-handed and works with his upper wing-case; the female is right-handed and scrapes with her lower wing-

case. Besides, with her, there is no such thing as a mirror, that is to say, no shiny membrane resembling a flake of mica. The bow rubs across the rough vein of the opposite scale and in this way produces simultaneous vibration in the two fitted spherical domes.

The vibrating part is double, therefore, but too stiff and clumsy to produce a sound of any depth. The song, in any case rather thin, is even more plaintive than the male's. The insect is not lavish with it. If I do not interfere, my captives never add their note to the concert of their caged companions; on the other hand, when seized and worried, they utter a moan at once. It seems likely that, in a state of liberty, things happen otherwise. The dumb beauties in my bell-jars are not for nothing endowed with a double cymbal and a bow. The instrument that moans with fright must also ring out joyously on occasion.

What purpose is served by the Grasshopper's sound-apparatus? I will not go so far as to refuse it a part in the pairing, or to deny it a persuasive murmur, sweet to her who hears it: that would be flying in the face of the evidence. But this is not its prin-

cipal function. Before anything else, the insect uses it to express its joy in living, to sing the delights of existence with a belly well filled and a back warmed by the sun, as witness the big Decticus and the male Grasshopper, who, after the wedding, exhausted for good and all and taking no further interest in pairing, continue to stridulate merrily as long as their strength holds out.

The Grasshopper tribe has its bursts of gladness; it has moreover the advantage of being able to express them with a sound, the simple satisfaction of the artist. The little journeyman whom I see in the evening returning from the workyard on his way home, where his supper awaits him, whistles and sings for his own pleasure, with no intention of making himself heard, nor any wish to attract an audience. In his artless and almost unconscious fashion, he tells the joys of a hard day's work done and of his plateful of steaming cabbage. Even so most often does the singing insect stridulate: it is celebrating life.

Some go farther. If existence has its sweets, it also has its sorrows. The saddle-bearing Grasshopper of the vines is able to

translate both of these into sound. In a trailing melody, he sings to the bushes of his happiness; in a like melody, hardly altered, he pours forth his griefs and his fears. His mate, herself an instrumentalist, shares this privilege. She exults and laments with two cymbals of another pattern.

When all is said, the cogged drum need not be looked down upon. It enlivens the lawns, murmurs the joys and tribulations of existence, sends the lover's call echoing all around, brightens the weary waiting of the lonely ones, tells of the perfect blossoming of insect life. Its stroke of the bow is almost a voice.

And this magnificent gift, so full of promise, is granted only to the inferior races, coarse natures, near akin to the crude beginnings of the carboniferous period. If, as we are told, the superior insect descends from ancestors who have been gradually transformed, why did it not preserve that fine inheritance of a voice which has sounded from the earliest ages?

Can it be that the theory of progressive acquirements is only a specious lure? Are we to abandon the savage theory of the crushing of the weak by the strong, of the

less well-endowed by their more highly-gifted rivals? Is it permissible to doubt, when the evolutionists talk to us of the survival of the fittest? Yes, indeed it is!

We are told as much by a certain Libellula of the carboniferous age (*Meganeura Monyi,* BRONG.), measuring over two feet across the wings. The giant Dragon-fly, who terrified the small winged folk with her sawlike mandibles, has disappeared, whereas the puny Agrion, with her bronze or azure abdomen, still hovers over the reeds of our rivers.

So have her contemporaries disappeared, the monstrous sauroid fishes, mailed in enamel and armed to the teeth. Their scarce successors are mere abortions. The splendid series of Cephalopods with partitioned shells, including certain Ammonites of the diameter of a cartwheel, has no other representative in our present seas than that modest fireman's helmet, the Nautilus. The Megalosaurus, a saurian twenty-five yards long, was a more alarming figure in our country-sides than the Grey Lizard of the walls. One of man's contemporaries, that monumental beast the Mammoth, is known only by his remains; and his near kinsman

the Elephant, a mere Sheep beside him, goes on prospering. What a shock to the law of the survival of the strongest! The mighty have gone under; and the weak fill their place.

CHAPTER XIV

THE GREEN GRASSHOPPER

WE are in the middle of July. The astronomical dog-days are just beginning; but in reality the torrid season has anticipated the calendar and for some weeks past the heat has been overpowering.

This evening in the village they are celebrating the National Festival.[1] While the little boys and girls are hopping around a bonfire whose gleams are reflected upon the church-steeple, while the drum is pounded to mark the ascent of each rocket, I am sitting alone in a dark corner, in the comparative coolness that prevails at nine o'clock, harking to the concert of the festival of the fields, the festival of the harvest, grander by far than that which, at this moment, is being celebrated in the village square with gunpowder, lighted torches, Chinese lanterns

[1] The 14th of July, the anniversary of the fall of the Bastille.—*Translator's Note.*

and, above all, strong drink. It has the simplicity of beauty and the repose of strength.

It is late; and the Cicadæ are silent. Glutted with light and heat, they have indulged in symphonies all the livelong day. The advent of the night means rest for them, but a rest frequently disturbed. In the dense branches of the plane-trees, a sudden sound rings out like a cry of anguish, strident and short. It is the desperate wail of the Cicada, surprised in his quietude by the Green Grasshopper, that ardent nocturnal huntress, who springs upon him, grips him in the side, opens and ransacks his abdomen. An orgy of music, followed by butchery.

I have never seen and never shall see that supreme expression of our national revelry, the military review at Longchamp; nor do I much regret it. The newspapers tell me as much about it as I want to know. They give me a sketch of the site. I see, installed here and there amid the trees, the ominous Red Cross, with the legend, "Military Ambulance; Civil Ambulance." There will be bones broken, apparently; cases of sunstroke; regrettable deaths, perhaps. It is all provided for and all in the programme.

Even here, in my village, usually so peace-

able, the festival will not end, I am ready to wager, without the exchange of a few blows, that compulsory seasoning of a day of merry-making. No pleasure, it appears, can be fully relished without an added condiment of pain.

Let us listen and meditate far from the tumult. While the disembowelled Cicada utters his protest, the festival up there in the plane-trees is continued with a change of orchestra. It is now the time of the nocturnal performers. Hard by the place of slaughter, in the green bushes, a delicate ear perceives the hum of the Grasshoppers. It is the sort of noise that a spinning-wheel makes, a very unobtrusive sound, a vague rustle of dry membranes rubbed together. Above this dull bass there rises, at intervals, a hurried, very shrill, almost metallic clicking. There you have the air and the recitative, intersected by pauses. The rest is the accompaniment.

Despite the assistance of a bass, it is a poor concert, very poor indeed, though there are about ten executants in my immediate vicinity. The tone lacks intensity. My old tympanum is not always capable of perceiving these subtleties of sound. The little that

reaches me is extremely sweet and most appropriate to the calm of twilight. Just a little more breadth in your bow-stroke, my dear Green Grasshopper, and your technique would be better than the hoarse Cicada's, whose name and reputation you have been made to usurp in the countries of the north.

Still, you will never equal your neighbour, the little bell-ringing Toad, who goes tinkling all round, at the foot of the plane-trees, while you click up above. He is the smallest of my batrachian folk and the most venturesome in his expeditions.

How often, at nightfall, by the last glimmers of daylight, have I not come upon him as I wandered through my garden, hunting for ideas! Something runs away, rolling over and over in front of me. Is it a dead leaf blown along by the wind? No, it is the pretty little Toad disturbed in the midst of his pilgrimage. He hurriedly takes shelter under a stone, a clod of earth, a tuft of grass, recovers from his excitement and loses no time in picking up his liquid note.

On this evening of national rejoicing, there are nearly a dozen of him tinkling against one another around me. Most of them are crouching among the rows of

flower-pots that form a sort of lobby outside my house. Each has his own note, always the same, lower in one case, higher in another, a short, clear note, melodious and of exquisite purity.

With their slow, rhythmical cadence, they seem to be intoning litanies. *Cluck,* says one; *click,* responds another, on a finer note; *clock,* adds a third, the tenor of the band. And this is repeated indefinitely, like the bells of the village pealing on a holiday: *cluck, click, clock; cluck, click, clock!*

The batrachian choristers remind me of a certain harmonica which I used to covet when my six-year-old ear began to awaken to the magic of sounds. It consisted of a series of strips of glass of unequal length, hung on two stretched tapes. A cork fixed to a wire served as a hammer. Imagine an unskilled hand striking at random on this key-board, with a sudden clash of octaves, dissonances and topsy-turvy chords; and you will have a pretty clear idea of the Toads' litany.

As a song, this litany has neither head nor tail to it; as a collection of pure sounds, it is delicious. This is the case with all the music in nature's concerts. Our ear dis-

covers superb notes in it and then becomes refined and acquires, outside the realities of sound, that sense of order which is the first condition of beauty.

Now this sweet ringing of bells between hiding-place and hiding-place is the matrimonial oratorio, the discreet summons which every Jack issues to his Jill. The sequel to the concert may be guessed without further enquiry; but what it would be impossible to foresee is the strange finale of the wedding. Behold the father, in this case a real *paterfamilias*, in the noblest sense of the word, coming out of his retreat one day in an unrecognizable state. He is carrying the future, tight-packed around his hind-legs; he is changing houses laden with a cluster of eggs the size of pepper-corns. His calves are girt, his thighs are sheathed with the bulky burden; and it covers his back like a beggar's wallet, completely deforming him.

Whither is he going, dragging himself along, incapable of jumping, thanks to the weight of his load? He is going, the fond parent, where the mother refuses to go; he is on his way to the nearest pond, whose warm waters are indispensable to the tadpoles' hatching and existence. When the

eggs are nicely ripened around his legs under the humid shelter of a stone, he braves the damp and the daylight, he the passionate lover of dry land and darkness; he advances by short stages, his lungs congested with fatigue. The pond is far away, perhaps; no matter: the plucky pilgrim will find it.

He's there. Without delay, he dives, despite his profound antipathy to bathing; and the cluster of eggs is instantly removed by the legs rubbing against each other. The eggs are now in their element; and the rest will be accomplished of itself. Having fulfilled his obligation to go right under, the father hastens to return to his well-sheltered home. He is scarcely out of sight before the little black tadpoles are hatched and playing about. They were but waiting for the contact of the water in order to burst their shells.

Among the singers in the July gloaming, one alone, were he able to vary his notes, could vie with the Toad's harmonious bells. This is the little Scops-owl, that comely nocturnal bird of prey, with the round gold eyes. He sports on his forehead two small feathered horns which have won for him in the district the name of *Machoto banarudo,*

the Horned Owl. His song, which is rich enough to fill by itself the still night air, is of a nerve-shattering monotony. With imperturbable and measured regularity, for hours on end, *kew, kew,* the bird spits out its cantata to the moon.

One of them has arrived at this moment, driven from the plane-trees in the square by the din of the rejoicings, to demand my hospitality. I can hear him in the top of a cypress near by. From up there, dominating the lyrical assembly, at regular intervals he cuts into the vague orchestration of the Grasshoppers and the Toads.

His soft note is contrasted, intermittently, with a sort of Cat's mew, coming from another spot. This is the call of the Common Owl, the meditative bird of Minerva. After hiding all day in the seclusion of a hollow olive-tree, he started on his wanderings when the shades of evening began to fall. Swinging along with a sinuous flight, he came from somewhere in the neighbourhood to the pines in my enclosure, whence he mingles his harsh mewing, slightly softened by distance, with the general concert.

The Green Grasshopper's clicking is too faint to be clearly perceived amidst these

clamourers; all that reaches me is the least ripple, just noticeable when there is a moment's silence. He possesses as his apparatus of sound only a modest drum and scraper, whereas they, more highly privileged, have their bellows, the lungs, which send forth a column of vibrating air. There is no comparison possible. Let us return to the insects.

One of these, though inferior in size and no less sparingly equipped, greatly surpasses the Grasshopper in nocturnal rhapsodies. I speak of the pale and slender Italian Cricket (*Œcanthus pellucens,* SCOP.), who is so puny that you dare not take him up for fear of crushing him. He makes music everywhere among the rosemary-bushes, while the Glow-worms light up their blue lamps to complete the revels. The delicate instrumentalist consists chiefly of a pair of large wings, thin and gleaming as strips of mica. Thanks to these dry sails, he fiddles away with an intensity capable of drowning the Toads' fugue. His performance suggests, but with more brilliancy, more *tremolo* in the execution, the song of the Common Black Cricket. Indeed the mistake would certainly be made by any one who did not

know that, by the time that the very hot weather comes, the true Cricket, the chorister of spring, has disappeared. His pleasant violin has been succeeded by another more pleasant still and worthy of special study. We shall return to him at an opportune moment.

These then, limiting ourselves to select specimens, are the principal participants in this musical evening: the Scops-owl, with his languorous solos; the Toad, that tinkler of sonatas; the Italian Cricket, who scrapes the first string of a violin; and the Green Grasshopper, who seems to beat a tiny steel triangle.

We are celebrating to-day, with greater uproar than conviction, the new era, dating politically from the fall of the Bastille; they, with glorious indifference to human things, are celebrating the festival of the sun, singing the happiness of existence, sounding the loud hosanna of the July heats.

What care they for man and his fickle rejoicings! For whom or for what will our squibs be spluttering a few years hence? Far-seeing indeed would he be who could answer the question. Fashions change and bring us the unexpected. The time-serving

rocket spreads its sheaf of sparks for the public enemy of yesterday, who has become the idol of to-day. To-morrow it will go up for somebody else.

In a century or two, will any one, outside the historians, give a thought to the taking of the Bastille? It is very doubtful. We shall have other joys and also other cares.

Let us look a little farther ahead. A day will come, so everything seems to tell us, when, after making progress upon progress, man will succumb, destroyed by the excess of what he calls civilization. Too eager to play the god, he cannot hope for the animal's placid longevity; he will have disappeared when the little Toad is still saying his litany, in company with the Grasshopper, the Scops-owl and the others. They were singing on this planet before us; they will sing after us, celebrating what can never change, the fiery glory of the sun.

I will dwell no longer on this festival and will become once more the naturalist, anxious to obtain information concerning the private life of the insect. The Green Grasshopper (*Locusta viridissima,* LIN.) does not appear to be common in my neighbourhood. Last year, intending to make a study of this in-

sect and finding my efforts to hunt it fruitless, I was obliged to have recourse to the good offices of a forest-ranger, who sent me a pair of couples from the Lagarde plateau, that bleak district where the beech-tree begins its escalade of the Ventoux.

Now and then freakish fortune takes it into her head to smile upon the persevering. What was not to be found last year has become almost common this summer. Without leaving my narrow enclosure, I obtain as many Grasshoppers as I could wish. I hear them rustling at night in the green thickets. Let us make the most of the windfall, which perhaps will not occur again.

In the month of June, my treasures are installed, in a sufficient number of couples, under a wire cover standing on a bed of sand in an earthen pan. It is indeed a magnificent insect, pale-green all over, with two whitish stripes running down its sides. Its imposing size, its slim proportions and its great gauze wings make it the most elegant of our Locustidæ. I am enraptured with my captives. What will they teach me? We shall see. For the moment, we must feed them.

I have here the same difficulty that I had

with the Decticus. Influenced by the general diet of the Orthoptera,[1] those ruminants of the greenswards, I offer the prisoners a leaf of lettuce. They bite into it, certainly, but very sparingly and with a scornful tooth. It soon becomes plain that I am dealing with half-hearted vegetarians. They want something else: they are beasts of prey, apparently. But what manner of prey? A lucky chance taught me.

At break of day I was pacing up and down outside my door, when something fell from the nearest plane-tree with a shrill grating sound. I ran up and saw a Grasshopper gutting the belly of an exhausted Cicada. In vain the victim buzzed and waved his limbs: the other did not let go, dipping her head right into the entrails and rooting them out by small mouthfuls.

I knew what I wanted to know: the attack had taken place up above, early in the morning, while the Cicada was asleep; and the plunging of the poor wretch, dissected alive, had made assailant and assailed fall in a

[1] The order of insects comprising the Grasshoppers, Locusts, Crickets, Cockroaches, Mantes and Earwigs. The Cicada, with whom the present volume opens, and the Foamy Cicadella, with whom it closes, belong to the order of Homoptera.—*Translator's Note.*

bundle to the ground. Since then I have repeatedly had occasion to witness similar carnage.

I have even seen the Grasshopper—the height of audacity, this—dart in pursuit of a Cicada in mad flight. Even so does the Sparrow-hawk pursue the Swallow in the sky. But the bird of prey here is inferior to the insect. It attacks a weaker than itself. The Grasshopper, on the other hand, assaults a colossus, much larger than herself and stronger; and nevertheless the result of the unequal fight is not in doubt. The Grasshopper rarely fails with the sharp pliers of her powerful jaws to disembowel her capture, which, being unprovided with weapons, confines itself to crying out and kicking.

The main thing is to retain one's hold of the prize, which is not difficult in somnolent darkness. Any Cicada encountered by the fierce Locustid on her nocturnal rounds is bound to die a lamentable death. This explains those sudden agonized notes which grate through the woods at late, unseasonable hours, when the cymbals have long been silent. The murderess in her suit of apple-green has pounced on some sleeping Cicada.

My boarders' menu is settled: I will feed them on Cicadæ. They take such a liking to this fare that, in two or three weeks, the floor of the cage is a knacker's yard strewn with heads and empty thoraces, with torn-off wings and disjointed legs. The belly alone disappears almost entirely. This is the tit-bit, not very substantial, but extremely tasty, it would seem. Here, in fact, in the insect's crop, the syrup is accumulated, the sugary sap which the Cicada's gimlet taps from the tender bark. Is it because of this dainty that the prey's abdomen is preferred to any other morsel? It is quite possible.

I do, in fact, with a view to varying the diet, decide to serve up some very sweet fruits, slices of pear, grape-pips, bits of melon. All this meets with delighted appreciation. The Green Grasshopper resembles the English: she dotes on underdone rump-steak seasoned with jam.[1] This perhaps is

[1] The author was obviously thinking of the Englishman's saddle of mutton and red-currant jelly. The mistake has been repeated much nearer to these shores. I have in mind the true story of an Irish king's counsel singing the praises of another, still among us, who had married an English wife and who, in the course of an extensive practice in the House of Lords, spent much of his time in England:

"Ah, —— —— is a real gentleman! He speaks with

why, on catching the Cicada, she first rips up his paunch, which supplies a mixture of flesh and preserves.

To eat Cicadæ and sugar is not possible in every part of the country. In the north, where she abounds, the Green Grasshopper would not find the dish which attracts her so strongly here. She must have other resources. To convince myself of this, I give her Anoxiæ (*A. pilosa,* FAB.), the summer equivalent of the spring Cockchafer. The Beetle is accepted without hesitation. Nothing is left of him but the wing-cases, head and legs. The result is the same with the magnificent plump Pine Cockchafer (*Melolontha fullo,* LIN.), a sumptuous morsel which I find next day eviscerated by my gang of knackers.

These examples teach us enough. They tell us that the Grasshopper is an inveterate consumer of insects, especially of those which are not protected by too hard a cuirass; they are evidence of tastes which

an English accent, quotes Euripides in the original Latin and takes jam with his meat."

I venture to think that Fabre, in the gentleness of his heart, would have forgiven his translator for quoting this flippant anecdote. I have no other excuse.—*Translator's Note.*

are highly carnivorous, but not exclusively so, like those of the Praying Mantis, who refuses everything except game. The butcher of the Cicadæ is able to modify an excessively heating diet with vegetable fare. After meat and blood, sugary fruit-pulp; sometimes even, for lack of anything better, a little green stuff.

Nevertheless, cannibalism is prevalent. True, I never witness in my Grasshopper-cages the savagery which is so common in the Praying Mantis, who harpoons her rivals and devours her lovers; but, if some weakling succumb, the survivors hardly ever fail to profit by his carcass as they would in the case of any ordinary prey. With no scarcity of provisions as an excuse, they feast upon their defunct companion. For the rest, all the sabre-bearing clan display, in varying degrees, a propensity for filling their bellies with their maimed comrades.

In other respects, the Grasshoppers live together very peacefully in my cages. No serious strife ever takes place among them, nothing beyond a little rivalry in the matter of food. I hand in a piece of pear. A Grasshopper alights on it at once. Jealously she kicks away any one trying to bite at the

delicious morsel. Selfishness reigns everywhere. When she has eaten her fill, she makes way for another, who in her turn becomes intolerant. One after the other, all the inmates of the menagerie come and refresh themselves. After cramming their crops, they scratch the soles of their feet a little with their mandibles, polish up their forehead and eyes with a leg moistened with spittle and then, hanging to the trelliswork or lying on the sand in a posture of contemplation, blissfully they digest and slumber most of the day, especially during the hottest part of it.

It is in the evening, after sunset, that the troop becomes lively. By nine o'clock the animation is at its height. With sudden rushes they clamber to the top of the dome, to descend as hurriedly and climb up once more. They come and go tumultuously, run and hop around the circular track and, without stopping, nibble at the good things on the way.

The males are stridulating by themselves, here and there, teasing the passing fair with their antennæ. The future mothers stroll about gravely, with their sabre half-raised. The agitation and feverish excitement means

that the great business of pairing is at hand. The fact will escape no practised eye.

It is also what I particularly wish to observe. My chief object in stocking my cages was to discover how far the strange nuptial manners revealed by the White-faced Decticus might be regarded as general. My wish is satisfied, but not fully, for the late hours at which events take place did not allow me to witness the final act of the wedding. It is late at night or early in the morning that things happen.

The little that I see is confined to interminable preludes. Standing face to face, with foreheads almost touching, the lovers feel and sound each other for a long time with their limp antennæ. They suggest two fencers crossing and recrossing harmless foils. From time to time, the male stridulates a little, gives a few short strokes of the bow and then falls silent, feeling perhaps too much overcome to continue. Eleven o'clock strikes; and the declaration is not yet over. Very regretfully, but conquered by sleepiness, I quit the couple.

Next morning, early, the female carries, hanging at the bottom of her ovipositor, the queer bladderlike arrangement that surprised

us so much in the Decticus. It is an opaline capsule, the size of a large pea and roughly subdivided into a small number of egg-shaped vesicles. When the Grasshopper walks, the thing scrapes along the ground and becomes dirty with sticky grains of sand.

The final banquet of the female Decticus is seen again here in all its hideousness. When, after a couple of hours, the fertilizing capsule is drained of its contents, the Grasshopper devours it bit by bit; for a long time she chews and rechews the gummy morsel and ends by swallowing it all down. In less than half a day, the milky burden has disappeared, consumed with zest down to the last atom.

The inconceivable therefore, imported, one would think, from another planet, so far removed is it from earthly habits, reappears with no noticeable variation in the Grasshopper, following on the Decticus. What singular folk are the Locustidæ, one of the oldest races in the animal kingdom on dry land! It seems probable that these eccentricities are the rule throughout the order. Let us consult another sabre-bearer.

I select the Ephippiger (*Ephippigera vitium,* SERV.), who is so easy to rear on

bits of pear and lettuce-leaves. It is in July and August that things happen. A little way off, the male is stridulating by himself. His ardent bow-strokes set his whole body quivering. Then he stops. Little by little, with slow and almost ceremonious steps, the caller and the called come closer together. They stand face to face, both silent, both stationary, their antennæ gently swaying, their fore-legs raised awkwardly and giving a sort of handshake at intervals. The peaceful interview lasts for hours. What do they say to each other? What vows do they exchange? What does their ogling mean?

But the moment has not yet come. They separate, they fall out and each goes his own way. The coolness does not last long. Here they are together again. The tender declarations are resumed, with no more success than before. At last, on the third day, I behold the end of the preliminaries. The male slips discreetly under his companion, backwards, according to the immemorial laws and customs of the Crickets. Stretched out behind and lying on his back, he clings to the ovipositor, his prop. The pairing is accomplished.

The result is an enormous spermatophore, a sort of opalescent raspberry with large seeds. Its colour and shape remind one of a cluster of Snail's-eggs. I remember seeing the same effect once with a Decticus, but in a less striking form; and I find it again in the Green Grasshopper's spermatophore. A thin median groove divides the whole into two symmetrical bunches, each comprising seven or eight spherules. The two nodes situated right and left of the bottom of the ovipositor are more transparent than the others and contain a bright orange-red kernel. The whole thing is attached by a wide pedicle, a dab of sticky jelly.

As soon as the thing is placed in position, the shrunken male flees and goes to recruit, after his disastrous prowess, on a slice of pear. The other, not at all troubled in spite of her heavy load, wanders about on the trelliswork of the cage, taking very short steps as she slightly raises her raspberry, this enormous burden, equal in bulk to half the creature's abdomen.

Two or three hours pass in this way. Then the Ephippiger curves herself into a ring and with her mandibles picks off particles of the nippled capsule, without burst-

ing it, of course, or allowing the contents to flow forth. She strips its surface by removing tiny shreds, which she chews in a leisurely fashion and swallows. This fastidious consuming by atoms is continued for a whole afternoon. Next day the raspberry has disappeared; the whole of it has been gulped down during the night.

At other times the end is less quick and, above all, less repulsive. I have kept a note of an Ephippiger who was dragging her satchel along the ground and nibbling at it from time to time. The soil is uneven and rugged, having been recently turned over with the blade of a knife. The raspberry-like capsule picks up grains of sand and little clods of earth, which increase the weight of the load considerably, though the insect appears to pay no heed to it. Sometimes the carting becomes laborious, because the load sticks to some bit of earth that refuses to move. In spite of the efforts made to release the thing, it does not become detached from the point where it hangs under the ovipositor, thus proving that it possesses no small power of adhesion.

All through the evening, the Ephippiger roams about aimlessly, now on the wire-

work, anon on the ground, wearing a preoccupied air. Oftener still she stands without moving. The capsule withers a little, but does not decrease notably in volume. There are no more of those mouthfuls which the Ephippiger snatched at the beginning; and the little that has already been removed affects only the surface.

Next day, things are as they were. There is nothing new, nor on the morrow either, save that the capsule withers still more, though its two red dots remain almost as bright as at first. Finally, after sticking on for forty-eight hours, the whole thing comes off without the insect's intervention.

The capsule has yielded its contents. It is a dried-up wreck, shrivelled beyond recognition, left lying in the gutter and doomed sooner or later to become the booty of the Ants. Why is it thus abandoned when, in other cases, I have seen the Ephippiger so greedy for the morsel? Perhaps because the nuptial dish had become too gritty with grains of sand, so unpleasant to the teeth.

Another Locustid, the Phaneroptera who carries a short yataghan bent into a reaping-hook (*P. falcata,* SCOP.), has made up to me in part for my stud troubles. Repeatedly,

but always under conditions which did not allow of completing my observation, I have caught her carrying the fertilizing-concern under the base of her sabre. It is a diaphanous, oval phial, measuring three or four millimetres [1] and hanging from a crystal thread, a neck almost as long as the distended part. The insect does not touch it, but leaves the phial to dry up and shrivel where it is.[2]

Let us be content with this. These five examples, furnished by such different genera, Decticus, Analota, Grasshopper, Ephippiger and Phaneroptera, prove that the Locustid, like the Scolopendra and the Cephalopod, is a belated representative of the manners of antiquity, a valuable specimen of the genetic eccentricities of olden times.

[1] .117 to .156 inch.—*Translator's Note.*

[2] Fuller details on this curious subject would be out of place in a book in which anatomy and physiology cannot always speak quite freely. They will be found in my essay on the Locustidæ which appeared in the *Annales des sciences naturelles,* 1896.—*Author's Note.*

CHAPTER XV

THE CRICKET: THE BURROW; THE EGG

ALMOST as famous as the Cicada, the Field Cricket, the denizen of the greenswards, figures among the limited but glorious number of the classic insects. He owes this honour to his song and his house. One thing alone is lacking to complete his renown. By a regrettable omission, the master of the art of making animals talk gives him hardly two lines.

In one of his fables he shows us the Hare seized with terror at the sight of his ears, which scandalmongers will not fail to describe as horns at a time when to be horned is dangerous. The prudent animal packs up his traps and makes off:

"Adieu, voisin Grillon," dit-il; "je pars d'ici;
"Mes oreilles enfin seraient cornes aussi."

The Cricket answers:

"Cornes cela! Vous me prenez pour cruche!
"Ce sont oreilles que Dieu fit."

The Hare insists:

"On les fera passer pour cornes." [1]

And that is all. What a pity that La Fontaine did not make the insect hold forth at greater length! The good-natured Cricket is depicted for us in a couple of lines which already show the master's touch. No, indeed, he is no fool: his big head might have found some capital things to say. And yet the Hare was perhaps not wrong to take his departure in a hurry. When slander is at your heels, the best thing is to fly.

[1] "Fare thee well, good neighbour Cricket; from thy presence I must flee;
"Mine ears also will be taken for a pair of horns," said he.
"Horns, i' faith!" the Cricket answered. "Is thy servant mad or blind?
"Those are ears which thy Creator with His own hand hath designed!"
"Yet the world will one day call them horns," his fellow made reply,
"And ere that day dawn, my neighbour, I will bid this place good-bye."

Florian [1] was less concise in his story, which is on another theme; but what a long way we are from the warmth and vigour of old La Fontaine! In Florian's fable *Le Grillon,* there are plenty of flowery meadows and blue skies; Dame Nature and affectation go hand in hand; in short, we have the feeble artificialities of a lifeless rhetoric, which loses sight of the thing described for the sake of the description. It lacks the simplicity of truth and also the saving salt of humour.

Besides, what a preposterous idea, to represent the Cricket as discontented, bewailing his condition in despair! All who have studied him know, on the contrary, that he is very well pleased with his own talent and his hole. This, moreover, is what the fabulist makes him admit, after the Butterfly's discomfiture:

"Combien je vais aimer ma retraite profonde!
"Pour vivre heureux, vivons caché!" [2]

[1] Jean Pierre Claris de Florian (1755-1794), Voltaire's grand-nephew, the leading French fabulist, after La Fontaine.—*Translator's Note.*

[2] "My snug little home is a place of delight:
"If you want to live happy, live hidden from sight!"

I find more force and more truth in the apologue by the nameless friend to whom I owe the Provençal piece, *La Cigalo e la Fournigo.* He will forgive me if for the second time I expose him, without his consent, to the dangerous honour of print. Here it is:

Le Grillon

L'histoire des bêtes rapporte
Qu'autrefois un pauvre grillon,
Prenant le soleil sur sa porte,
Vit passer un beau papillon.

Un papillon à longues queues,
Superbe, des mieux décorés,
Avec rangs de lunules bleues,
Galons noirs et gros points dorés.[1]

"Vole, vole," lui dit l'ermite,
"Sur les fleurs, du matin au soir;
"Ta rose, ni ta marguerite
Ne valent mon humble manoir."

Il disait vrai. Vient un orage
Et le papillon est noyé

[1] My friend, who is always accurate in his descriptions, is here speaking, if I be not mistaken, of the Swallow-tail.—*Author's Note.*

The Life of the Grasshopper

Dans un bourbier; la fange outrage
Le velours de son corps broyé.

Mais la tourmente en rien n'étonne
Le grillon, qui, dans son abri,
Qu'il pleuve, qu'il vente, qu'il tonne,
Vit tranquille et chante cri-cri.

Ah! n'allons pas courir le monde
Parmi les plaisirs et les fleurs;
L'humble foyer, sa paix profonde
Nous épargneront bien des pleurs.

THE CRICKET

Among the beasts a tale is told
How a poor Cricket ventured nigh
His door to catch the sun's warm gold
And saw a radiant Butterfly.

She passed with tails thrown proudly back
And long gay rows of crescents blue,
Brave yellow stars and bands of black,
The lordliest fly that ever flew.

" Ah, fly away," the hermit said,
" Daylong among your flowers to roam;
" Nor daisies white nor roses red
" Will compensate my lowly home."

True, all too true! There came a storm
And caught the other in its flood,

Staining her broken velvet form
And covering her wings with mud.

The Cricket, sheltered from the rain,
Chirped and looked on with tranquil eye;
For him the thunder pealed in vain,
The gale and torrent passed him by.

Then shun the world, nor take your fill
Of any of its joys or flowers;
A lowly fire-side, calm and still,
At least will grant you tearless hours![1]

There I recognize my Cricket. I see him curling his antennæ on the threshold of his burrow, keeping his belly cool and his back to the sun. He is not jealous of the Butterfly; on the contrary, he pities her, with that air of mocking commiseration familiar in the ratepayer who owns a house of his own and sees passing before his door some wearer of a gaudy costume with no place to lay her head. Far from complaining, he is very well satisfied with both his house and his violin. A true philosopher, he knows the vanity of things and appreciates the charm of a modest retreat away from the riot of pleasure-seekers.

[1] For the translation of these and the other verses in this chapter I am indebted to my friend Mr. Stephen McKenna.—*Translator's Note.*

Yes, the description is about right, though it remains very inadequate and does not bear the stamp of immortality. The Cricket is still waiting for the few lines needed to perpetuate his merits; and, since La Fontaine neglected him, he will have to go on waiting a long time.

To me, as a naturalist, the outstanding feature in the two fables—a feature which I should find repeated elsewhere, beyond a doubt, if my library were not reduced to a small row of odd volumes on a deal shelf—is the burrow on which the moral is founded. Florian speaks of the snug retreat; the other praises his lowly home. It is the dwelling therefore that above all compels attention, even that of the poet, who cares little in general for realities.

In this respect, indeed, the Cricket is extraordinary. Of all our insects, he alone, on attaining maturity, possesses a fixed abode, the monument of his industry. During the bad season of the year, most of the others burrow or skulk in some temporary refuge, a refuge obtained free of cost and abandoned without regret. Several create marvels, with a view to settling their family: cotton satchels, baskets made of leaves, towers of

cement. Some carnivorous larvæ dwell in permanent ambuscades, where they lie in wait for their prey. The Tiger-beetle, among others, digs itself a perpendicular hole, which it closes with its flat, bronze head. Whoever ventures on the insidious foot-bridge vanishes down the gulf, whose trap-door at once tips up and disappears beneath the feet of the wayfarer. The Ant-lion makes a funnel in the sand. The Ant slides down its very loose slope and is bombarded with projectiles hurled from the bottom of the crater by the hunter, who turns his neck into a catapult. But these are all temporary refuges, nests or traps.

The laboriously constructed residence, in which the insect settles down with no intention of moving, either in the happy spring or the woful winter season; the real manor, built for peace and comfort and not as a hunting-box or a nursery: this is known to the Cricket alone. On some sunny, grassy slope he is the owner of a hermitage. While all the others lead vagabond lives, sleeping in the open air or under the casual shelter of a dead leaf, a stone, or the peeling bark of an old tree, he is a privileged person with a permanent address.

A serious problem is that of the home. It has been solved by the Cricket, by the Rabbit and, lastly, by man. In my neighbourhood, the Fox and the Badger have holes the best part of which is supplied by the irregularities of the rock. A few repairs; and the dug-out is completed. Cleverer than they, the Rabbit builds his house by burrowing wheresoever he pleases, when there is no natural passage that allows him to settle down free of any trouble.

The Cricket surpasses all of them. Scorning chance refuges, he always chooses the site of his abode, in well-drained ground, with a pleasant sunny aspect. He refuses to make use of fortuitous cavities, which are incommodious and rough; he digs every bit of his villa, from the entrance-hall to the back-room.

I see no one above him, in the art of house-building, except man; and even man, before mixing mortar to hold stones together, before kneading clay to coat his hut of branches, fought with wild beasts for the possession of a refuge in the rocks or an underground cavern.

Then how are the privileges of instinct distributed? Here is one of the humblest,

able to lodge himself to perfection. He has a home, an advantage unknown to many civilized beings; he has a peaceful retreat, the first condition of comfort; and nobody around him is capable of settling down. He has no rivals until you come to ourselves.

Whence does he derive this gift? Is he favoured with special tools? No, the Cricket is not an incomparable excavator; in fact, one is rather surprised at the result when one considers the feebleness of his resources.

Can it be made necessary by the demands of an exceptionally delicate skin? No, among his near kinsmen, other skins, no less sensitive than his, do not dread the open air at all.

Can it be a propensity inherent in the anatomical structure, a talent prescribed by the secret promptings of the organism? No, my neighbourhood boasts three other Crickets (*Gryllus bimaculatus,* DE GEER; *G. desertus,* PALLAS.; *G. burdigalensis;* LATR.), who are so like the Field Cricket in appearance, colour and structure that, at the first glance, one would take them for him. The first is as large as he is, or even larger. The second represents him reduced to about half

his size. The third is smaller still. Well, of these faithful copies, these doubles of the Field Cricket, not one knows how to dig himself a burrow. The Double-spotted Cricket inhabits those heaps of grass left to rot in damp places; the Solitary Cricket roams about the crevices in the dry clods turned up by the gardener's spade; the Bordeaux Cricket is not afraid to make his way into our houses, where he sings discreetly, during August and September, in some dark, cool spot.

There is no object in continuing our questions: each would meet with no for an answer. Instinct, which stands revealed here and disappears there despite organisms alike in all respects, will never tell us its causes. It depends so little on an insect's stock of tools that no anatomical detail can explain it to us and still less make us foresee it. The four almost identical Crickets, of whom one alone understands the art of burrowing, add their evidence to the manifold proofs already supplied; they confirm in a striking fashion our profound ignorance of the origin of instinct.

Who does not know the Cricket's abode! Who has not, as a child playing in

the fields, stopped in front of the hermit's cabin! However light your footfall, he has heard you coming and has abruptly withdrawn to the very bottom of his hiding-place. When you arrive, the threshold of the house is deserted.

Everybody knows the way to bring the skulker out. You insert a straw and move it gently about the burrow. Surprised at what is happening above, tickled and teased, the Cricket ascends from his secret apartment; he stops in the passage, hesitates and enquires into things by waving his delicate antennæ; he comes to the light and, once outside, he is easy to catch, so greatly have events puzzled his poor head. Should he be missed at the first attempt, he may become more suspicious and obstinately resist the titillation of the straw. In that case, we can flood him out with a glass of water.

O those adorable times when we used to cage our Crickets and feed them on a leaf of lettuce, those childish hunting-trips along the grassy paths! They all come back to me to-day, as I explore the burrows in search of subjects for my studies; they appear to me almost in their pristine freshness when my companion, little Paul, already an expert in

the tactical use of the straw, springs up suddenly, after a long trial of skill and patience with the recalcitrant, and, brandishing his closed hand in the air, cries, excitedly:

"I've got him, I've got him!"

Quick, here's a bag; in you go, my little Cricket! You shall be petted and pampered; but mind you teach us something and, first of all, show us your house.

It is a slanting gallery, situated in the grass, on some sunny bank which soon dries after a shower. It is nine inches long at most, hardly as thick as one's finger and straight or bent according to the exigencies of the ground. As a rule, a tuft of grass, which is respected by the Cricket when he goes out to browse upon the surrounding turf, half-conceals the home, serving as a porch and throwing a discreet shade over the entrance. The gently-sloping threshold, scrupulously raked and swept, is carried for some distance. This is the belvedere on which, when everything is peaceful round about, the Cricket sits and scrapes his fiddle.

The inside of the house is devoid of luxury, with bare and yet not coarse walls. Ample leisure allows the inhabitant to do away with any unpleasant roughness. At the

end of the passage is the bedroom, the terminal alcove, a little more carefully smoothed than the rest and slightly wider. All said, it is a very simple abode, exceedingly clean, free from damp and conforming with the requirements of a well-considered system of hygiene. On the other hand, it is an enormous undertaking, a regular Cyclopean tunnel, when we consider the modest means of excavation. Let us try to be present at the work. Let us also enquire at what period the enterprise begins. This obliges us to go back to the egg.

Any one wishing to see the Cricket lay her eggs can do so without making great preparations: all that he wants is a little patience, which, according to Buffon, is genius, but which I, more modestly, will describe as the observer's chief virtue. In April, or at latest in May, we establish isolated couples of the insect in flower-pots containing a layer of heaped-up earth. Their provisions consist of a lettuce-leaf renewed from time to time. A square of glass covers the retreat and prevents escape.

Some extremely interesting facts can be obtained with this simple installation, supplemented, if need be, with a wire-gauze cover,

the best of all cages. We shall return to this matter. For the moment, let us watch the laying and make sure that the propitious hour does not evade our vigilance.

It is in the first week in June that my assiduous visits begin to show satisfactory results. I surprise the mother standing motionless, with her ovipositor planted perpendicularly in the soil. For a long time she remains stationed at the same point, heedless of her indiscreet caller. At last she withdraws her dibble, removes, more or less perfunctorily, the traces of the boring-hole, takes a moment's rest, walks away and starts again somewhere else, now here, now there, all over the area at her disposal. Her behaviour, though her movements are slower, is a repetition of what the Decticus has shown us. Her egg-laying appears to me to be ended within the twenty-four hours. For greater certainty, I wait a couple of days longer.

I then dig up the earth in the pot. The straw-coloured eggs are cylinders rounded at both ends and measuring about one-ninth of an inch in length. They are placed singly in the soil, arranged vertically and grouped in more or less numerous patches, which cor-

respond with the successive layings. I find them all over the pot, at a depth of three-quarters of an inch. There are difficulties in examining a mass of earth through a magnifying-glass; but, allowing for these difficulties, I estimate the eggs laid by one mother at five or six hundred. So large a family is sure to undergo a drastic purging before long.

The Cricket's egg is a little marvel of mechanism. After hatching, it appears as an opaque white sheath, with a round and very regular aperture at the top; to the edge of this a cap adheres, forming a lid. Instead of bursting anyhow under the thrusts or cuts of the new-born larva, it opens of its own accord along a specially prepared line of least resistance.

It became important to observe the curious hatching. About a fortnight after the egg is laid, two large, round, rusty-black eye-dots darken the front end. A little way above these two dots, right at the apex of the cylinder, you see the outline of a thin circular swelling. This is the line of rupture which is preparing. Soon the translucency of the egg enables the observer to perceive the delicate segmentation of the tiny creature

within. Now is the time to redouble our vigilance and multiply our visits, especially in the morning.

Fortune, which loves the persevering, rewards me for my assiduity. All round this swelling where, by a process of infinite delicacy, the line of least resistance has been prepared, the end of the egg, pushed back by the inmate's forehead, becomes detached, rises and falls to one side like the top of a miniature scent-bottle. The Cricket pops out like a Jack-in-the-box.

When he is gone, the shell remains distended, smooth, intact, pure white, with the cap or lid hanging from the opening. A bird's egg breaks clumsily under the blows of a wart that grows for the purpose at the end of the chick's beak; the Cricket's egg, endowed with a superior mechanism, opens like an ivory case. The thrust of the inmate's head is enough to work the hinge.

The hatching of the eggs is hastened by the glorious weather; and the observer's patience is not much tried, the rapidity rivalling that of the Dung-beetles. The summer solstice has not yet arrived when the ten couples interned under glass for the benefit of my studies are surrounded by their

numerous progeny. The egg-stage, therefore, lasts just about ten days.

I said above that, when the lid of the ivory case is lifted, a young Cricket pops out. This is not quite accurate. What appears at the opening is the swaddled grub, as yet unrecognizable in a tight-fitting sheath. I expected to see this wrapper, this first set of baby-clothes, for the same reasons that made me anticipate it in the case of the Decticus:

"The Cricket," said I to myself, "is born underground. He also sports two very long antennæ and a pair of overgrown hind-legs, all of which are cumbrous appendages at the time of the emergence. He must therefore possess a tunic in which to make his exit."

My forecast, correct enough in principle, was only partly confirmed. The new-born Cricket does in fact possess a temporary structure; but, so far from employing it for the purpose of hoisting himself outside, he throws off his clothes as he passes out of the egg.

To what circumstances are we to attribute this departure from the usual practice? Perhaps to this: the Cricket's egg stays in the ground for only a few days before hatching; the egg of the Decticus remains there for

eight months. The former, save for rare exceptions in a season of drought, lies under a thin layer of dry, loose, unresisting earth; the latter, on the contrary, finds itself in soil which has been caked together by the persistent rains of autumn and winter and which therefore presents serious difficulties. Moreover, the Cricket is shorter and stouter, less long-shanked than the Decticus. These would appear to be the reasons for the difference between the two insects in respect of their methods of emerging. The Decticus, born lower down, under a close-packed layer, needs a climbing-costume with which the Cricket is able to dispense, being less hampered and nearer to the surface and having only a powdery layer of earth to pass through.

Then what is the object of the tights which the Cricket flings aside as soon as he is out of the egg? I will answer this question with another: what is the object of the two white stumps, the two pale-coloured embryo wings carried by the Cricket under his wing-cases, which are turned into a great mechanism of sound? They are so insignificant, so feeble that the insect certainly makes no use of them, any more than the

Dog utilizes the thumb that hangs limp and lifeless at the back of his paw.

Sometimes, for reasons of symmetry, the walls of a house are painted with imitation windows to balance the other windows, which are real. This is done out of respect for order, the supreme condition of the beautiful. In the same way, life has its symmetries, its repetitions of a general prototype. When abolishing an organ that has ceased to be employed, it leaves vestiges of it to maintain the primitive arrangement.

The Dog's rudimentary thumb predicates the five-fingered hand that characterizes the higher animals; the Cricket's wing-stumps are evidence that the insect would normally be capable of flight; the moult undergone on the threshold of the egg is reminiscent of the tight-fitting wrapper needed for the laborious exit of the Locustidæ born underground. They are so many symmetrical superfluities, so many remains of a law that has fallen into disuse but never been abrogated.

As soon as he is deprived of his delicate tunic, the young Cricket, pale all over, almost white, begins to battle with the soil overhead. He hits out with his mandibles; he sweeps aside and kicks behind him the

powdery obstruction, which offers no resistance. Behold him on the surface, amidst the joys of the sunlight and the perils of conflict with the living, poor, feeble creature that he is, hardly larger than a Flea. In twenty-four hours he colours and turns into a magnificent blackamoor, whose ebon hue vies with that of the adult insect. All that remains of his original pallor is a white sash that girds his chest and reminds us of a baby's leading-string. Very nimble and alert, he sounds the surrounding space with his long, quivering antennæ, runs about and jumps with an impetuosity in which his future obesity will forbid him to indulge.

This is also the age when the stomach is still delicate. What sort of food does he need? I do not know. I offer him the adult's treat, tender lettuce-leaves. He scorns to touch them, or perhaps he takes mouthfuls so exceedingly small that they escape me.

In a few days, with my ten households, I find myself overwhelmed with family cares. What am I to do with my five or six thousand Crickets, a pretty flock, no doubt, but impossible to rear in my ignorance of the treatment required? I will

set you at liberty, my little dears; I will entrust you to nature, the sovran nurse.

Thus it comes to pass. I release my legions in the enclosure, here, there and everywhere, in the best places. What a concert I shall have outside my door next year, if they all turn out well! But no, the symphony will probably be one of silence, for the savage pruning due to the mother's fertility is bound to come. All that I can hope for is that a few couples may survive extermination.

As in the case of the young Praying Mantes, the first that hasten to this manna and the most eager for the slaughter are the little Grey Lizard and the Ant. The latter, loathsome freebooter that she is, will, I fear, not leave me a single Cricket in the garden. She snaps up the poor little creatures, eviscerates them and gobbles them down at frantic speed.

Oh, the execrable wretch! And to think that we place the Ant in the front rank of insects! Books are written in her honour and the stream of eulogy never ceases; the naturalists hold her in the greatest esteem and add daily to her reputation, so true is it, among animals as among men, that of the

various ways of making history, the surest way is to do harm to others.[1]

Nobody asks after the Dung-beetle and the Necrophorus,[2] invaluable scavengers both, whereas everybody knows the Gnat, that drinker of men's blood; the Wasp, that hot-tempered swashbuckler, with her poisoned dagger; and the Ant, that notorious evil-doer, who, in our southern villages, saps and imperils the rafters of a dwelling with the same zest with which she devours a fig. I need not trouble to say more: every one will discover in the records of mankind similar instances of usefulness ignored and frightfulness exalted.

The massacre instituted by the Ants and other exterminators is so great that my erstwhile populous colonies in the enclosure become too small to enable me to continue my observations; and I am driven to have recourse to information outside. In August, among the fallen leaves, in those little oases where the grass has not been wholly scorched by the sun, I find the young Cricket already rather big, black all over like the adult,

[1] For the author's only essay on Ants, cf. *The Mason-bees:* chap. vi.—*Translator's Note.*

[2] Or Burying-beetle.—*Translator's Note.*

with not a vestige of the white girdle of his early days. He has no domicile. The shelter of a dead leaf, the cover of a flat stone are enough for him; they represent the tents of a nomad who cares not where he lays his head.

This vagabond life continues until the middle of autumn. It is then that the Yellow-winged Sphex [1] hunts down the wanderers, an easy prey, and stores her bag of Crickets underground. She decimates those who have survived the Ants' devastating raids. A settled dwelling, dug a few weeks before the usual time, would save them from the spoilers. The sorely-tried victims do not think of it. The bitter experience of the centuries has taught them nothing. Though already strong enough to dig a protecting burrow, they remain invincibly faithful to their ancient customs and would go on roaming though the Sphex stabbed the last of their race.

It is at the close of October, when the first cold weather threatens, that the burrow is taken in hand. The work is very simple, judging by the little that my observation of

[1] Cf. *The Hunting Wasps:* chaps. iv to vii.—*Translator's Note.*

the caged insect has shown me. The digging is never done at a bare point in the pan, but always under the shelter of a withered lettuce-leaf, some remnant of the food provided. This takes the place of the grass screen that seems indispensable to the secrecy of the establishment.

The miner scrapes with his fore-legs and uses the pincers of his mandibles to extract the larger bits of gravel. I see him stamping with his powerful hind-legs, furnished with a double row of spikes; I see him raking the rubbish, sweeping it backwards and spreading it slantwise. There you have the method in its entirety.

The work proceeds pretty quickly at first. In the yielding soil of my cages, the digger disappears underground after a spell that lasts a couple of hours. He returns to the entrance at intervals, always backwards and always sweeping. Should he be overcome with fatigue, he takes a rest on the threshold of his half-finished home, with his head outside and his antennæ waving feebly. He goes in again and resumes work with pincers and rakes. Soon the periods of repose become longer and wear out my patience.

The most urgent part of the work is done.

Once the hole is a couple of inches deep, it suffices for the needs of the moment. The rest will be a long-winded business, resumed in a leisurely fashion, a little one day and a little the next; the hole will be made deeper and wider as demanded by the inclemencies of the weather and the growth of the insect. Even in winter, if the temperature be mild and the sun playing over the entrance to the dwelling, it is not unusual to see the Cricket shooting out rubbish, a sign of repairs and fresh excavations. Amidst the joys of spring, the upkeep of the building still continues. It is constantly undergoing improvements and repairs until the owner's decease.

April comes to an end and the Cricket's song begins, at first in rare and shy solos, soon developing into a general symphony in which each clod of turf boasts its performer. I am more than inclined to place the Cricket at the head of the spring choristers. In our waste lands, when the thyme and the lavender are gaily flowering, he has as his partner the Crested Lark, who rises like a lyrical rocket, his throat swelling with notes, and from the sky, invisible in the clouds, sheds his sweet music upon the fallows. Down below the Crickets chant the responses. Their

song is monotonous and artless, but so well-suited, in its very crudity, to the rustic gladness of renascent life! It is the hosanna of the awakening, the sacred alleluia understood by swelling seed and sprouting blade. Who deserves the palm in this duet? I should award it to the Cricket. He surpasses them all, thanks to his numbers and his unceasing note. Were the Lark to fall silent, the fields blue-grey with lavender, swinging its fragrant censers before the sun, would still receive from this humble chorister a solemn celebration.

CHAPTER XVI

THE CRICKET: THE SONG; THE PAIRING

IN steps anatomy and says to the Cricket, bluntly:

"Show us your musical-box."

Like all things of real value, it is very simple; it is based on the same principle as that of the Grasshoppers: a bow with a hook to it and a vibrating membrane. The right wing-case overlaps the left and covers it almost completely, except where it folds back sharply and encases the insect's side. It is the converse of what we see in the Green Grasshopper, the Decticus, the Ephippiger and their kinsmen. The Cricket is right-handed, the others left-handed.

The two wing-cases have exactly the same structure. To know one is to know the other. Let us describe the one on the right. It is almost flat on the back and slants suddenly at the side in a right-angled fold, encircling the abdomen with a pinion which

has delicate, parallel veins running in an oblique direction. The dorsal surface has stronger and more prominent nervures, of a deep-black colour, which, taken together, form a strange, complicated design, bearing some resemblance to the hieroglyphics of an Arabic manuscript.

By holding it up to the light, one can see that it is a very pale red, save for two large adjoining spaces, a larger, triangular one in front and a smaller, oval one at the back. Each is framed in a prominent nervure and scored with faint wrinkles. The first, moreover, is strengthened with four or five chevrons; the second with only one, which is bow-shaped. These two areas represent the Grasshoppers' mirror; they constitute the sounding-areas. The skin is finer here than elsewhere and transparent, though of a somewhat smoky tint.

The front part, which is smooth and slightly red in hue, is bounded at the back by two curved, parallel veins, having between them a cavity containing a row of five or six little black wrinkles that look like the rungs of a tiny ladder. The left wing-case presents an exact duplicate of the right. The wrinkles constitute the friction-nerv-

ures which intensify the vibration by increasing the number of the points that are touched by the bow.

On the lower surface, one of the two veins that surround the cavity with the rungs becomes a rib cut into the shape of a hook. This is the bow. I count in it about a hundred and fifty triangular teeth or prisms of exquisite geometrical perfection.

It is a fine instrument indeed, far superior to that of the Decticus. The hundred and fifty prisms of the bow, biting into the rungs of the opposite wing-case, set the four drums in motion at one and the same time, the lower pair by direct friction, the upper pair by the shaking of the friction-apparatus. What a rush of sound! The Decticus, endowed with a single paltry mirror, can be heard just a few steps away; the Cricket, possessing four vibratory areas, throws his ditty to a distance of some hundreds of yards.

He vies with the Cicada in shrillness, without having the latter's disagreeable harshness. Better still: this favoured one knows how to modulate his song. The wing-cases, as we said, extend over either side in a wide fold. These are the dampers

which, lowered to a greater or lesser depth, alter the intensity of the sound and, according to the extent of their contact with the soft abdomen, allow the insect to sing *mezza voce* at one time and *fortissimo* at another.

The exact similarity of the two wing-cases is worthy of attention. I can see clearly the function of the upper bow and the four sounding-areas which it sets in motion; but what is the good of the lower one, the bow on the left wing? Not resting on anything, it has nothing to strike with its hook, which is as carefully toothed as the other. It is absolutely useless, unless the apparatus can invert the order of its two parts and place that above which was below. After such an inversion, the perfect symmetry of the instrument would cause the necessary mechanism to be reproduced in every respect and the insect would be able to stridulate with the hook which is at present unemployed. It would scrape away as usual with its lower fiddlestick, now become the upper; and the tune would remain the same.

Is this permutation within its power? Can the insect use both pot-hooks, changing from one to the other when it grows tired,

which would mean that it could keep up its music all the longer? Or are there at least some Crickets who are permanently left-handed? I expected to find this the case, because of the absolute symmetry of the wing-cases. Observation convinced me of the contrary. I have never come across a Cricket that failed to conform with the general rule. All those whom I have examined —and they are many—without a single exception carried the right wing-case above the left.

Let us try to interfere and to bring about by artifice what natural conditions refuse to show us. Using my forceps, very gently, of course, and without straining the wing-cases, I make these overlap the opposite way. This result is easily obtained with a little dexterity and patience. The thing is done. Everything is in order. There is no dislocation at the shoulders; the membranes are without a crease. Things could not be better-arranged under normal conditions.

Was the Cricket going to sing, with his inverted instrument? I was almost expecting it, appearances were so much in its favour; but I was soon undeceived. The insect submits for a few moments; then, find-

ing the inversion uncomfortable, it makes an effort and restores the instrument to its regular position. In vain I repeat the operation: the Cricket's obstinacy triumphs over mine. The displaced wing-cases always resume their normal arrangement. There is nothing to be done in this direction.

Shall I be more successful if I make my attempt while the wing-cases are still immature? At the actual moment, they are stiff membranes, resisting any changes. The fold is already there; it is at the outset that the material should be manipulated. What shall we learn from organs that are quite new and still plastic, if we invert them as soon as they appear? The thing is worth trying.

For this purpose, I go to the larva and watch for the moment of its metamorphosis, a sort of second birth. The future wings and wing-cases form four tiny flaps which, by their shape and their scantiness, as well as by the way in which they stick out in different directions, remind me of the short jackets worn by the Auvergne cheese-makers. I am most assiduous in my attendance, lest I should miss the propitious moment, and at last have a chance to witness the moult-

ing. In the early part of May, at about eleven in the morning, a larva casts off its rustic garments before my eyes. The transformed Cricket is now a reddish brown, all but the wings and wing-cases, which are beautifully white.

Both wings and wing-cases, which only issued from their sheaths quite recently, are no more than short, crinkly stumps. The former remain in this rudimentary state, or nearly so. The latter gradually develop bit by bit and open out; their inner edges, with a movement too slow to be perceived, meet one another, on the same plane and at the same level. There is no sign to tell us which of the two wing-cases will overlap the other. The two edges are now touching. A few moments longer and the right will be above the left. This is the time to intervene.

With a straw I gently change the position, bringing the left edge over the right. The insect protests a little and disturbs my manœuvring. I insist, while taking every possible care not to endanger these tender organs, which look as though they were cut out of wet tissue-paper. And I am quite successful: the left wing-case pushes forward above the right, but only very little, barely

a twenty-fifth of an inch. We will leave it alone: things will now go of themselves.

They go as well as one could wish, in fact. Continuing to spread, the left wing-case ends by entirely covering the other. At three o'clock in the afternoon, the Cricket has changed from a reddish hue to black, but the wing-cases are still white. Two hours more and they also will possess the normal colouring.

It is over. The wing-cases have come to maturity under the artificial arrangement; they have opened out and moulded themselves according to my plans; they have taken breadth and consistency and have been born, so to speak, in an inverted position. As things now are, the Cricket is left-handed. Will he definitely remain so? It seems to me that he will; and my hopes rise higher on the morrow and the day after, for the wing-cases continue, without any trouble, in their unusual arrangement. I expect soon to see the artist wield that particular fiddle-stick which the members of his family never employ. I redouble my watchfulness, so as to witness his first attempt at playing the violin.

On the third day, the novice makes a

start. A few brief grating sounds are heard, the noise of a machine out of gear shifting its parts back into their proper order. Then the song begins, with its accustomed tone and rhythm.

Veil your face, O foolish experimenter, overconfident in your mischievous straw! You thought that you had created a new type of instrumentalist; and you have obtained nothing at all. The Cricket has thwarted your schemes: he is scraping with his right fiddlestick and always will. With a painful effort, he has dislocated his shoulders, which were made to mature and harden the wrong way; and, in spite of a set that seemed definite, he has put back on top that which ought to be on top and underneath that which ought to be underneath. Your sorry science tried to make a left-handed player of him. He laughs at your devices and settles down to be right-handed for the rest of his life.

Franklin left an eloquent plea on behalf of the left hand, which, he considered, deserved as careful training as its fellow. What an immense advantage it would be thus to have two servants each as capable as the other! Yes, certainly; but, except for

a few rare instances, is this equality of strength and skill in the two hands possible?

The Cricket answers no: there is an original weakness in the left side, a want of balance, which habit and training can to a certain extent correct, but which they can never cause wholly to disappear. Though shaped by a training which takes it at its birth and moulds and solidifies it on the top of the other, the left wing-case none the less resumes the lower position when the insect tries to sing. As to the cause of this original inferiority, that is a problem which belongs to embryogenesis.

My failure confirms the fact that the left wing-case is unable to make use of its bow, even when supplemented by the aid of art. Then what is the object of that hook whose exquisite precision yields in no respect to that of the other? We might appeal to reasons of symmetry and talk about the repetition of an archetypal design, as I, for want of a better argument, did just now in the matter of the cast raiment which the young Cricket leaves on the threshold of his ovular sheath; but I prefer to confess that this would be but the semblance of an explanation, wrapped up in specious language. For the Decticus,

the Grasshopper and the other Locustidæ would come and show us their wing-cases, one with the bow only, the other with the mirror, and say:

"Why should the Cricket, our near kinsman, be symmetrical, whereas all of us Locustidæ, without exception, are asymmetrical?"

There is no valid answer to their objection. Let us confess our ignorance and humbly say:

"I do not know."

It wants but a Midge's wing to confound our proudest theories.

Enough of the instrument; let us listen to the music. The Cricket sings on the threshold of his house, in the cheerful sunshine, never indoors. The wing-cases, lifted in a double inclined plane and now only partly covering each other, utter their stridulant *cri-cri* in a soft tremolo. It is full, sonorous, nicely cadenced and lasts indefinitely. Thus are the leisures of solitude beguiled all through the spring. The anchorite at first sings for his own pleasure. Glad to be alive, he chants the praises of the sun that shines upon him, the grass that feeds him, the peaceful retreat that harbours him. The

first object of his bow is to hymn the blessings of life.

The hermit also sings for the benefit of his fair neighbours. The Cricket's nuptials would, I warrant, present a curious scene, if it were possible to follow their details far from the commotions of captivity. To seek an opportunity would be labour lost, for the insect is very shy. I must await one. Shall I ever find it? I do not despair, in spite of the extraordinary difficulty. For the moment, let us be satisfied with what we can learn from probability and the vivarium.

The two sexes dwell apart. Both are extremely domestic in their habits. Whose business is it to make a move? Does the caller go in search of the called? Does the serenaded one come to the serenader? If, at pairing-time, sound were the sole guide where homes are far apart, it would be necessary for the silent partner to go to the noisy one's trysting-place. But I imagine that, in order to save appearances—and this accords with what I learn from my prisoners—the Cricket has special faculties that guide him towards his mute lady-love.

When and how is the meeting effected? I suspect that things take place in the friendly

gloaming and upon the very threshold of the bride's home, upon that sanded esplanade, that state courtyard, which lies just outside the entrance.

A nocturnal journey like this, at some twenty paces' distance, is a serious undertaking for the Cricket. When he has accomplished his pilgrimage, how will he, the stay-at-home, with his imperfect knowledge of topography, find his own house again? To return to his Penates must be impossible. He roams, I fear, at random, with no place to lay his head. He has neither the time nor the heart to dig himself the new burrow which would be his salvation; and he dies a wretched death, forming a savoury mouthful for the Toad on his night rounds. His visit to the lady Cricket has cost him his home and his life. What does he care! He has done his duty as a Cricket.

This is how I picture events when I combine the probabilities of the open country with the realities of the vivarium. I have several couples in one cage. As a rule, my captives refrain from digging themselves a dwelling. The hour has passed for any long waiting or long wooing. They wander about the enclosed space, without troubling about

a fixed home, or else lie low under the shelter of a lettuce-leaf.

Peace reigns in the household until the quarrelsome instincts of pairing-time break out. Then affrays between suitors are frequent and lively, though not serious. The two rivals stand face to face, bite each other in the head, that solid, fang-proof helmet, roll each other over, pick themselves up and separate. The vanquished Cricket makes off as fast as he can; the victor insults him with a boastful ditty; then, moderating his tone, he veers and tacks around the object of his desires.

He makes himself look smart and, at the same time, submissive. Gripping one of his antennæ with a claw, he takes it in his mandibles to curl it and grease it with saliva. With his long spurred and red-striped hind-legs, he stamps the ground impatiently and kicks out at nothing. His emotion renders him dumb. His wing-cases, it is true, quiver rapidly, but they give forth no sound, or at most an agitated rustling.

A vain declaration! The female Cricket runs and hides herself in a curly bit of lettuce. She lifts the curtain a little, however, and looks out and wishes to be seen.

Et fugit ad salices; et se cupit ante videri,[1]

said the delightful eclogue, two thousand years ago. Thrice-consecrated strategy of love, thou art everywhere the same!

The song is resumed, intersected by silences and murmuring quavers. Touched by so much passion, Galatea, I mean Dame Cricket, issues from her hiding-place. The other goes up to her, suddenly spins round, turns his back to her and flattens his abdomen against the ground. Crawling backwards, he makes repeated efforts to slip underneath. The curious backward manœuvre at last succeeds. Gently, my little one, gently! Discreetly flattened out, you manage to slide under. That's done it! We have our couple. A spermatophore, a granule smaller than a pin's head, hangs where it ought to. The meadows will have their Crickets next year.

The laying of the eggs follows soon after. Then this cohabitation in couples in a cage often brings about domestic quarrels. The father is knocked about and crippled; his

[1] "Then tripping to the woods the wanton hies
And wishes to be seen before she flies."
—VIRGIL, *Pastorals:* book i.; Dryden's translation.

violin is smashed to bits. Outside my cells, in the open fields, the hen-pecked husband is able to take to flight; and that indeed is what he appears to do, not without good reason.

This ferocious aversion of the mother for the father, even among the most peaceable, gives food for thought. The sweetheart of but now, if he come within reach of the lady's teeth, is eaten more or less; he does not escape from the final interviews without leaving a leg or two and some shreds of wing-cases behind him. Locusts and Crickets, those lingering representatives of a bygone world, tell us that the male, a mere secondary wheel in life's original mechanism, has to disappear at short notice and make room for the real propagator, the real worker, the mother.

Later, in the higher order of creation, sometimes even among insects, he is awarded a task as a collaborator; and nothing better could be desired: the family must needs gain by it. But the Cricket, faithful to the old traditions, has not yet got so far. Therefore the object of yesterday's longing becomes to-day an object of hatred, ill-treated, disembowelled and eaten up.

Even when free to escape from his pugnacious mate, the superannuated Cricket soon perishes, a victim to life. In June, all my captives succumb, some dying a natural, others a violent death. The mothers survive for some time in the midst of their newly-hatched family. But things happen differently when the males have the advantage of remaining bachelors: they then enjoy a remarkable longevity. Let me relate the facts.

We are told that the music-loving Greeks used to keep Cicadæ in cages, the better to enjoy their singing. I venture to disbelieve the whole story. In the first place, the harsh clicking of the Cicadæ, when long continued at close quarters, is a torture to ears that are at all delicate. The Greeks' sense of hearing was too well-disciplined to take pleasure in such raucous sounds away from the general concert of the fields, which is heard at a distance.

In the second place, it is absolutely impossible to bring up Cicadæ in captivity, unless we cover over an olive-tree or a plane-tree, which would supply us with a vivarium very difficult to instal on a window-sill. A single day spent in a cramped enclosure

would make the high-flying insect die of boredom.

Is it not possible that people have confused the Cricket with the Cicada, as they also do the Green Grasshopper? With the Cricket they would be quite right. He is one who bears captivity gaily: his stay-at-home ways predispose him to it. He lives happily and whirrs without ceasing in a cage no larger than a man's fist, provided that we serve him with his lettuce-leaf every day. Was it not he whom the small boys of Athens reared in little wire cages hanging on a window-frame?

Their successors in Provence and all over the south have the same tastes. In the towns, a Cricket becomes the child's treasured possession. The insect, petted and pampered, tells him in its ditty of the simple joys of the country. Its death throws the whole household into a sort of mourning.

Well, these recluses, these compulsory celibates, live to be patriarchs. They keep fit and well long after their cronies in the fields have succumbed; and they go on singing till September. Those additional three months, a long space of time, double their existence in the adult form.

The cause of this longevity is obvious. Nothing wears one out so quickly as life. The wild Crickets have gaily spent their reserves of energy on the ladies; the more fervent their ardour, the speedier their dissolution. The others, their incarcerated kinsmen, leading a very quiet life, have acquired a further period of existence by reason of their forced abstinence from too costly joys. Having neglected to perform the superlative duty of a Cricket, they obstinately refuse to die until the very last moment.

A brief study of the three other Crickets of my neighbourhood has taught me nothing of any interest. Possessing no fixed abode, no burrow, they wander about from one temporary shelter to another, under the dry grass or in the cracks of the clods. They all carry the same musical instrument as the Field Cricket, with slight variations of detail. Their song is much alike in all cases, allowing for differences of size. The smallest of the family, the Bordeaux Cricket, stridulates outside my door, under the cover of the box borders. He even ventures into the dark corners of the kitchen, but his song is so faint that it takes a very attentive ear

to hear it and to discover at last where the insect lies hidden.

In our part of the world, we do not have the House Cricket, that denizen of bakers' shops and rural fireplaces. But, though the crevices under the hearthstones in my village are silent, the summer nights make amends by filling the country-side with a charming symphony unknown in the north. Spring, during its sunniest hours, has the Field Cricket as its musician; the calm summer nights have the Italian Cricket (*Œcanthus pellucens,* SCOP.). One diurnal, the other nocturnal, they share the fine weather between them. By the time that the first has ceased to sing, it is not long before the other begins his serenade.

The Italian Cricket has not the black dress and the clumsy shape characteristic of the family. He is, on the contrary, a slender, fragile insect, quite pale, almost white, as beseems his nocturnal habits. You are afraid of crushing him, if you merely take him in your fingers. He leads an aerial existence on shrubs of every kind, or on the taller grasses; and he rarely descends to earth. His song, the sweet music of the still, hot evenings from July to October, begins at

sunset and continues for the best part of the night.

This song is known to everybody here, for the smallest clump of bushes has its orchestra. It is heard even in the granaries, into which the insect sometimes strays, attracted by the fodder. But the pale Cricket's ways are so mysterious that nobody knows exactly the source of the serenade, which is very erroneously ascribed to the Common Black Cricket, who at this period is quite young and silent.

The song is a soft, slow *gri-i-i, gri-i-i,* which is rendered more expressive by a slight tremolo. On hearing it, we divine both the extreme delicacy and the size of the vibrating membranes. If nothing happen to disturb the insect, settled in the lower leaves, the sound remains unaltered; but, at the least noise, the executant becomes a ventriloquist. You heard him here, quite close, in front of you; and now, all of a sudden, you hear him over there, fifteen yards away, continuing his ditty softened by distance.

You move across. Nothing. The sound comes from the original place. No, it doesn't, after all. This time, it is coming from over there, on the left, or rather from

the right; or is it from behind? We are absolutely at a loss, quite unable to guide ourselves by the ear towards the spot where the insect is chirping.

It needs a fine stock of patience and the most minute precautions to capture the singer by the light of a lantern. The few specimens caught under these conditions and caged have supplied me with the little that I know about the musician who is so clever at baffling our ears.

The wing-cases are both formed of a broad, dry, diaphanous membrane, fine as a white onion-skin and capable of vibrating throughout its whole area. They are shaped like a segment of a circle thinning towards the upper end. This segment folds back at right angles along a prominent longitudinal vein and forms a flap which encloses the insect's side when at rest.

The right wing-case lies above the left. Its inner edge bears underneath, near the root, a knob which is the starting-point of five radiating veins, of which two run upwards, two downwards and the fifth almost transversely. The last-named, which is slightly reddish, is the main part, in short the bow, as is shown by the fine notches cut

across it. The rest of the wing-case presents a few other veins of minor importance, which keep the membrane taut without forming part of the friction-apparatus.

The left or lower wing-case is similarly constructed, with this difference that the bow, the knob and the veins radiating from it now occupy the upper surface. We find, moreover, that the two bows, the right and the left, cross each other obliquely.

When the song has its full volume, the wing-cases, raised high up and resembling a pair of large gauze sails, touch only at their inner edges. Then the two bows fit into each other slantwise and their mutual friction produces the sonorous vibration of the two stretched membranes.

The sound appears to be modified according as the strokes of each bow bear upon the knob, which is itself wrinkled, on the opposite wing-case, or upon one of the four smooth radiating veins. This would go some way towards explaining the illusions produced by music which seems to come from here, there and everywhere when the timid insect becomes distrustful.

The illusion of loud or soft, open or muffled sounds and consequently of distance,

which forms the chief resource of the ventriloquist's art, has another, easily discovered source. For the open sounds, the wing-cases are raised to their full height; for the muffled sounds, they are lowered more or less. In the latter position, their outer edges press to a varying extent upon the insect's yielding sides, thus more or less decreasing the vibratory surface and reducing the volume of sound.

A gentle touch with one's finger stifles the sound of a ringing wine-glass and changes it into a veiled, indefinite note that seems to come from afar. The pale Cricket knows this acoustic secret. He misleads those who are hunting for him by pressing the edges of his vibrating flaps against his soft abdomen. Our musical instruments have their dampers, their sourdines; that of *Œcanthus pellucens* vies with and surpasses them in the simplicity of its method and the perfection of its results.

The Field Cricket and his kinsmen also employ the sourdine by clasping their abdomen higher or lower with the edge of their wing-cases; but none of them obtains from this procedure such deceptive effects as those of the Italian Cricket.

In addition to this illusion of distance, which, at the faintest sound of footsteps, is constantly taking us by surprise, we have the purity of the note, with its soft tremolo. I know no prettier or more limpid insect song, heard in the deep stillness of an August evening. How often, *per amica silentia lunæ,*[1] have I lain down on the ground, screened by the rosemary-bushes, to listen to the delicious concert of the *harmas!*[2]

The nocturnal Cricket swarms in the enclosure. Every tuft of red-flowering rock-rose has its chorister; so has every clump of lavender. The bushy arbutus-shrubs, the turpentine-trees, all become orchestras. And, with its clear and charming voice, the whole of this little world is sending questions and responses from shrub to shrub, or rather, indifferent to the hymns of others, chanting its gladness for itself alone.

High up, immediately above my head, the Swan stretches its great cross along

[1] "Safe under covert of the silent night
And guided by the imperial galley's light."
—VIRGIL, *Æneid:* book ii.; Dryden's translation.

[2] The enclosed piece of waste land, adjoining his house at Sérignan, in which the author used to study his insects in their natural state. Cf. *The Life of the Fly:* chap. i.—*Translator's Note.*

the Milky Way; below, all around me, the insects' symphony rises and falls. The infinitesimal telling its joys makes me forget the pageant of the stars. We know nothing of those celestial eyes which look down upon us, placid and cold, with scintillations that are like blinking eyelids. Science tells us of their distance, their speed, their mass, their volume; it overwhelms us with enormous figures, stupefies us with immensities; but it does not succeed in stirring a fibre within us. Why? Because it lacks the great secret, that of life. What is there up there? What do those suns warm? Worlds like ours, reason declares; planets whereon life revolves in infinite variety. It is a superb conception of the universe, but, when all is said, only a conception, not supported by obvious facts, those supreme proofs within the reach of all. The probable, the extremely probable, is not the manifest, which forces itself upon us irresistibly and leaves no room for doubt.

In your company, on the contrary, O my Crickets, I feel the throbbing of life, which is the soul of our lump of clay; and that is why, under my rosemary-hedge, I give but an absent glance at the constellation of the

Swan and devote all my attention to your serenade! A dab of animated glair, capable of pleasure and of pain, surpasses in interest the immensity of brute matter.

CHAPTER XVII

THE LOCUSTS: THEIR FUNCTION; THEIR ORGAN OF SOUND

"MIND you are ready, children, to-morrow morning, before the sun gets too hot: we are going Locust-hunting."

This announcement throws the household into great excitement at bed-time. What do my little helpmates see in their dreams? Blue wings, red wings, suddenly flung out fanwise; long, saw-toothed legs, pale-blue or pink, which kick out when we hold their owners in our fingers; great shanks acting as springs that make the insect leap forward like a projectile shot from some dwarf catapult hidden in the grass.

What they behold in sleep's sweet magic lantern I also happen to see. Life lulls us with the same simple things in its first stages and its last.

If there be one peaceful and safe form of hunting, one that comes within the powers of

old age and childhood alike, it is Locust-hunting. Oh, what delicious mornings we owe to it! What happy moments when the mulberries are black and allow my assistants to go pilfering here and there in the bushes! What memorable excursions on the slopes covered with sparse grass, tough and burnt yellow by the sun! I retain a vivid recollection of all this; and my children will do the same.

Little Paul has nimble legs, a ready hand and a piercing eye. He inspects the clumps of everlastings where the Tryxalis solemnly nods his sugar-loaf head; he scrutinizes the bushes out of which the big Grey Locust suddenly flies like a little bird surprised by the hunter. Great disappointment on the part of the latter, who, after first rushing off at full speed, stops and gazes in wonder at this mock Swallow flying far away. He will have better luck another time. We shall not go home without a few of those magnificent prizes.

Younger than her brother, Marie Pauline patiently watches for the Italian Locust, with his pink wings and carmine hind-legs; but she really prefers another jumper, the most elegantly attired of all. Her favourite wears

a St. Andrew's cross on the small of his back, which is marked by four white, slanting stripes. His livery has patches of verdigris, the exact colour of the patina on old bronze medals. With her hand raised in the air, ready to swoop down, she approaches very softly, stooping low. Whoosh! That's done it! Quick, a screw of paper to receive the treasure, which, thrust head first into the opening, plunges with one bound to the bottom of the funnel.

Thus are our bags distended one by one; thus are our boxes filled. Before the heat becomes too great to bear, we are in possession of a number of varied specimens which, raised in captivity, will perhaps teach us something, if we know how to question them. Thereupon we go home again. The Locust has made three people happy at a small cost.

The first question that I put to my boarders is this:

"What function do you perform in the fields?"

You have a bad reputation, I know; the text-books describe you as noxious. Do you deserve this reproach? I take the liberty of doubting it, except, of course, in the case of

the terrible ravagers who form the scourge of Africa and the east.

The ill repute of those voracious eaters has left its mark on you all, though I look upon you as much more useful than injurious. Never, so far as I know, have our peasants complained of you. What damage could they lay to your charge?

You nibble the tops of the tough grasses which the Sheep refuses to touch; you prefer the lean swards to the fat pastures; you browse on sterile land where none but you would find the wherewithal to feed himself; you live upon what could never be used without the aid of your healthy stomach.

Besides, by the time that you frequent the fields, the only thing that might tempt you, the green wheat, has long since yielded its grain and disappeared. If you happen to get into the kitchen-gardens and levy toll on them to some slight extent, it is not a rank offence. A man can console himself for a piece bitten out of a leaf or two of salad.

To measure the importance of things by the foot-rule of one's own turnip-patch is a horrible method, which makes us forget the essential for the sake of a trivial detail. The short-sighted man would upset the order of

the universe rather than sacrifice a dozen plums. If he thinks of the insect at all, it is only to speak of its extermination.

Fortunately, this is not and never will be in his power. Look at the consequences, for instance, of the disappearance of the Locust, who is accused of stealing a few crumbs from earth's rich table. In September and October, the Turkeys are driven into the stubble-fields, under the charge of a child armed with two long reeds. The expanse over which the gobbling flock slowly spreads is bare, dry and burnt by the sun. At the most, a few ragged thistles raise their belated heads. What do the birds do in a desert like this, simply reeking with famine? They cram themselves, in order to do honour to the Christmas table; they wax fat; their flesh becomes firm and appetizing. With what, pray? With Locusts, whom they snap up here and there, a delicious stuffing for their greedy crops. This autumnal manna, which costs nothing and is richly flavoured, contributes to the elaboration and the improvement of the succulent roast that will be so largely eaten on the festive evening.

When the Guinea-fowl, that domesticated game-bird, roams around the farm, uttering

her rasping note, what is it that she seeks? Seeds, no doubt, but, above all things, Locusts, who puff her out under the wings with a pad of fat and give greater flavour to her flesh.

The Hen, much to our advantage, is just as fond of them. She well knows the virtues of that dainty dish, which acts as a tonic and increases her laying-capacity. When left at liberty, she hardly ever fails to lead her family to the stubble-fields, so that they may learn how to snap up the exquisite mouthful deftly. In fact, all the denizens of the poultry-yard, when free to wander about at will, owe to the Locust a valuable addition to their diet.

It becomes a much more important matter outside our domestic fowls. If you are a sportsman, if you are able to appreciate the value of the Red-legged Partridge, the glory of our southern hills, open the crop of the bird which you have just brought down. You will see that it contains a splendid certificate to the services rendered by the much-maligned insect. You will find it, nine times out of ten, more or less crammed with Locusts. The Partridge dotes on them, prefers them to seed as long as he is able to

catch them. This highly-flavoured, substantial, stimulating fare would almost make him forget the existence of seeds, if it were only there all the year round.

Let us now consult the illustrious black-footed tribe, so warmly celebrated by Tousserel.[1] The head of the family is the Wheatear, the *Cul-blanc*,[2] as the Provençal calls him, who grows disgracefully fat in September and supplies delicious material for the skewer. At the time when I used to indulge in ornithological expeditions, I made a practice of jotting down the contents of the birds' crops and gizzards, so as to become acquainted with their diet. Here is the Wheatear's bill of fare: Locusts, first of all; next, many various kinds of Beetles, such as Weevils, Opatra, Chrysomelæ, or Golden-apple-beetles, Cassidæ, or Tortoise-beetles, and Harpali; in the third place, Spiders, Iuli,[3] Woodlice and small Snails; lastly and

[1] Alphonse Tousserel (1803-1885), author of a number of interesting and valuable works on ornithology.—*Translator's Note.*

[2] Also known as the Stone-chat, Fallow-chat, Whin-chat, Fallow-finch and White-tail, which last corresponds with the *Cul-blanc* of the Provençal dialect. The French name for this Saxicola is the *Motteux*, or Clod-hopper.—*Translator's Note.*

[3] Wormlike Millepedes.—*Translator's Note.*

rarely, bramble-berries and the berries of the Cornelian cherry.

As you see, there is a little of all kinds of small game, just as it comes. The insect-eater does not turn his attention to berries except in the last resort, at seasons of dearth. Out of forty-eight cases mentioned in my notes, vegetable food appears only three times, in trifling proportions. The predominant item, both as regards frequency and quantity, is the Locust, the smaller specimens being chosen, in order not to tax the bird's swallowing-powers.

Even so with the other little birds of passage which, when autumn comes, call a halt in Provence and prepare for the great pilgrimage by accumulating on their rumps a travelling-allowance of fat. All of them feast on the Locust, that rich fare; all, in the waste lands and fallows, gather as best they can the hopping tit-bit, that source of vigour for flying. Locusts are the manna of little birds on their autumnal journey.

Nor does man himself scorn them. An Arab author quoted by General Daumas [1] in his book, *Le Grand désert,* tells us:

[1] General Eugène Daumas (1803-1871), the author of several works on Algeria.—*Translator's Note.*

The Life of the Grasshopper

"Grasshoppers[1] are of good nourishment for men and Camels. Their claws, wings and head are taken away and they are eaten fresh or dried, either roast or boiled and served with flesh, flour and herbs.

"When dried in the sun, they are ground to powder and mixed with milk or kneaded with flour; and they are then cooked with fat or with butter and salt.

"Camels eat them greedily and are given them dried or roast, heaped in a hollow between two layers of charcoal. Thus also do the Nubians eat them.

"When Miriam[2] prayed God that she might eat flesh unpolluted by blood, God sent her Grasshoppers.

"When the wives of the Prophet were sent Grasshoppers as a gift, they placed some of these in baskets and sent them to other women.

"Once, when the Caliph Omar was asked if it were lawful to eat Grasshoppers, he made answer:

"'Would that I had a basket of them to eat!'

[1] More correctly the Locust, not to be confused with the true Grasshopper, who carries a sabre.—*Author's Note.*

[2] The Blessed Virgin Mary.—*Author's Note.*

"Wherefore, from this testimony, it is very sure that, by the grace of God, Grasshoppers were given to man for his nourishment."

Without going so far as the Arab naturalist, which would presuppose a power of digestion not bestowed on every man, I feel entitled to say that the Locust is a gift of God to a multitude of birds, as witness the long array of gizzards which I consulted.

Many others, notably the reptile, hold him in esteem. I have found him in the belly of the *Rassado,* that terror of the small girls of Provence, I mean the Eyed Lizard, who loves rocky shelters turned into a furnace by a torrid sun. And I have often caught the little Grey Lizard of the walls in the act of carrying off, in his tapering snout, the *spolia opima* of some long-awaited Acridian.

Even fish revel in him, when good fortune brings him to them. The Locust's leap has no definite goal. A projectile discharged blindly, the insect comes down wherever the unpremeditated release of its springs shoots it. If the place where it falls happen to be the water, a fish is there at once to gobble up the dripping victim. It is sometimes a

fatal dainty, for anglers use the Locust when they wish to bait their hook with a particularly attractive morsel.

Without expatiating further on the devourers of this small game, I can clearly see the great usefulness of the Acridian who by successive leaps transmits to man, that most wasteful of eaters, the lean grass now converted into exquisite fare. Gladly therefore would I say, with the Arab writer:

"Wherefore, from this testimony, it is very sure that, by the grace of God, Grasshoppers were given to man for his nourishment."

One thing alone makes me hesitate: the direct consumption of the Locust. As regards indirect consumption, under the form of Partridge, young Turkey and others, none will think of denying him his praises. Is direct consumption then so unpleasant? That was not the opinion of Omar,[1] the mighty caliph, the destroyer of the library of Alexandria. His stomach was as rude as his intellect; and, by his own account, he

[1] Omar, the second caliph and the first to assume the title of Commander of the Faithful, reigned from 634 to his death in 644. The Alexandrian library was burnt in 640.—*Translator's Note.*

would have relished a basket of Grasshoppers.

Long before him, others were content to eat them, though in this case it was a wise frugality. Clad in his Camel's-hair garment, St. John the Baptist, the bringer of good tidings and the great stirrer of the populace in the days of Herod, lived in the desert on Grasshoppers and wild honey:

"And his meat was locusts and wild honey," says the Gospel according to St. Matthew.

Wild honey I know, if only from the pots of the Chalicodoma.[1] It is a very agreeable food. There remains the Grasshopper of the desert, otherwise the Locust. In my youth, like every small boy, I appreciated a Grasshopper's leg, which I used to eat raw. It is not without flavour. To-day let us rise a peg higher and try the fare of Omar and St. John the Baptist.

I capture some fat Locusts and have them cooked in a very rough and ready fashion, fried with butter and salt, as the Arab author prescribes. We all of us, big and little, partake of the queer dish at dinner.

[1] Cf. *The Mason-bees: passim.—Translator's Note.*

We pronounce favourably upon the caliph's delicacy. It is far superior to the Cicadæ extolled by Aristotle. It has a certain shrimpy flavour, a taste that reminds one of grilled Crab; and, were it not that the shell is very tough for such slight edible contents, I would go to the length of saying that it is good, without, however, feeling any desire for more.

My curiosity as a naturalist has now twice allowed itself to be tempted by the dishes of antiquity: Cicadæ first; Locusts next. Neither the one nor the other roused my enthusiasm. We must leave these things to the powerful jaws of the negroes and the huge appetite of which the famous caliph gave proof.

The queasiness of our stomachs, however, in no way decreases the Locusts' merits. Those little browsers of the burnt grass play a great part in the workshop where our food is prepared. They swarm in vast legions which roam over the barren wastes, pecking here and there, turning what could not otherwise be used into a foodstuff which is passed on to a host of consumers, including, first and foremost, the bird that often falls to man's share.

Pricked relentlessly by the needs of the stomach, the world knows no more imperative duty than the acquisition of food. To secure a seat in the refectory, each animal expends its sum total of activity, industry, toil, trickery and strife; and the general banquet, which should be a joy, is to many a torment. Man is far from escaping the miseries of the struggle for food. On the contrary, only too often he tastes them in all their bitterness.

Ingenious as he is, will he succeed in freeing himself from them? Science says yes. Chemistry promises, in the near future, a solution of the problem of subsistence. The sister science, physics, is preparing the way. Already it is contemplating how to get more and better work done by the sun, that great sluggard who thinks that he has done his duty by us when he sweetens our grapes and ripens our corn. It will bottle his heat, garner his rays, in order to control them and employ them where we think fit.

With these supplies of energy, the hearths will blaze, the wheels will turn, the pestles pound, the graters grate, the rollers grind; and the work of agriculture, so wasteful at present, thwarted as it is by the inclemency

of the seasons, will become factory-work, yielding economical and safe returns.

Then chemistry will step in, with its legion of cunning reagents. It will turn everything into nutritious matter, in a highly concentrated form, capable of being assimilated in its entirety and leaving hardly any foul residue. A loaf of bread will be a pill; a rumpsteak a drop of jelly. Of agricultural labour, the inferno of barbarian times, nothing will remain but a memory, of interest only to the historians. The last Sheep and the last Ox will figure, neatly stuffed, as curiosities in our museums, together with the Mammoth dug up from the Siberian ice-fields.

All that old lumber—herds and flocks, seeds, fruits and vegetables—is doomed to disappear some day. Progress demands it, we are told; and the chemist's retort, which, in its presumptuous fashion, recognizes nothing as impossible, repeats the assertion.

This golden age of foodstuffs leaves me very incredulous. When it is a question of obtaining some new toxin, science displays alarming ingenuity. Our laboratory collections are veritable arsenals of poisons. When the object is to invent a still in which

potatoes shall be made to yield torrents of alcohol capable of turning us into a nation of sots, the resources of industry know no limits. But to procure by artificial means a single mouthful of really nourishing matter is a very different business. Never has any such product simmered in our retorts. The future, beyond a doubt, will do no better. Organized matter, the only true food, escapes the formulæ of the laboratory. Its chemist is life.

We shall do well therefore to preserve agriculture and our herds. Let us leave our nourishment to be prepared by the patient work of plants and animals, let us mistrust the brutal factory and keep our confidence for more delicate methods and, in particular, for the Locust's stomach, which assists in the making of the Christmas Turkey. That stomach has culinary receipts which the chemist's retort will always envy without succeeding in imitating them.

This picker-up of nutritive trifles, destined to support a crowd of paupers, possesses musical powers wherewith to express his joys. Consider a Locust at rest, blissfully digesting his meal and enjoying the sunshine. With sharp strokes of the bow,

three or four times repeated and spaced with pauses, he sings his ditty. He scrapes his sides with his great hind-legs, using now one, now the other, anon both at a time.

The result is very poor, so slight indeed that I am obliged to have recourse to little Paul's ear in order to make sure that there is a sound at all. Such as it is, it resembles the creaking of the point of a needle pushed across a sheet of paper. There you have the whole song, so near akin to silence.

There is nothing more to be expected from so rudimentary an instrument. We have nothing here similar to what the Grasshopper clan have shown us: no toothed bow, no vibrating membrane stretched into a drum. Let us, for instance, take a look at the Italian Locust (*Caloptenus italicus,* LIN.), whose apparatus of sound is repeated in the other stridulating Acridians. His hinder thighs are keel-shaped above and below. Each surface, moreover, has two powerful longitudinal nervures. Between these main parts there is, in either case, a graduated row of smaller, chevron-shaped nervures; and the whole thing is as prominent and as plainly marked on this outer side as on the inner one. And what surprises me even

more than this similarity between the two surfaces is that all these nervures are smooth. Lastly, the lower edge of the wing-cases, the edge rubbed by the thighs which serve as a bow, also has nothing particular about it. We see, as indeed we do all over the wing-cases, nervures that are powerful but devoid of any rasping roughness or the least denticulation.

What can this artless attempt at a musical instrument produce? Just as much as a dry membrane will emit when you rub it. And for the sake of this trifle the insect lifts and lowers its thighs, in sharp jerks, and is satisfied with the result. It rubs its sides very much as we rub our hands together in sign of contentment, with no intention of making a sound. That is its own particular way of expressing its joy in life.

Examine it when the sky is partly obscured and the sun shines intermittently. There comes a rift in the clouds. Forthwith the thighs begin to scrape, increasing their activity as the sun grows hotter. The strains are very brief, but they are renewed so long as the sunshine continues. The sky becomes overcast. Then and there the song ceases, to be resumed with the next gleam of sun-

light, always in brief spasms. There is no mistaking it: here, in these fond lovers of the light, we have a mere expression of happiness. The Locust has his moments of gaiety when his crop is full and the sun benign.

Not all the Acridians indulge in this joyous rubbing. The Tryxalis (*Truxalis nasuta,* LIN.), who sports a pair of immensely elongated hind-legs, maintains a gloomy silence even under the most vigorous caresses of the sun. I have never seen him move his shanks like a bow; he seems unable to use them—so long are they—for anything but hopping.

Dumb likewise, apparently as a consequence of the excessive length of his hind-legs, the big Grey Locust (*Pachytilus cinerescens,* FABR.) has a peculiar way of diverting himself. The giant often visits me in the enclosure, even in the depth of winter. In calm weather, when the sun is hot, I surprise him in the rosemaries, with his wings unfurled and fluttering rapidly for a quarter of an hour at a time, as though for flight. His twirling is so gentle, in spite of its extreme speed, as to create hardly a perceptible rustle.

Others still are much less well-endowed.

One such is the Pedestrian Locust (*Pezotettix pedestris,* LIN.), the companion of the Alpine Analota on the ridges of the Ventoux. This foot-passenger strolling amid the paronychias (*P. serpyllifola*) which lie spread in silvery expanses over the Alpine region; this short-jacketed hopper, the guest of the androsaces (*A. villosa*), whose tiny flowers, white as the neighbouring snows, smile from out of their rosy eyes, has the same fresh colouring as the plants around him. The sunlight, less veiled in mists in the loftier regions, has made him a costume combining beauty and simplicity: a pale-brown satin back; a yellow abdomen; big thighs coral-red below; hind-legs a glorious azure-blue, with an ivory anklet in front. But, being incapable of going beyond the larval form, this dandy remains short-coated.

He has for wing-cases two wrinkled slips, distant one from the other and hardly covering the first segment of the abdomen, and for wings two stumps that are even more abbreviated. All this hardly covers his nakedness down to the waist. Any one seeing him for the first time takes him for a larva and is wrong. It is indeed the adult insect,

ripe for mating; and the insect will remain in this undress to the end.

Is it necessary to add that, with this skimpy jacket, stridulation is impossible? The big hind-thighs are there, it is true; but what is lacking, for them to rub upon, is the grating surface, the edge of the wing-cases. Whereas the other Locusts are not to be described as noisy, this one is absolutely dumb. In vain have the most delicate ears around me listened with might and main: there has never been the least sound during the three months' home breeding. This silent one must have other means of expressing his joys and summoning his partner to the wedding. What are they? I do not know.

Nor do I know why the insect deprives itself of wings and remains a plodding wayfarer, when its near kinsmen, on the same Alpine swards, are excellently equipped for flight. It possesses the germs of wing and wing-case, gifts which the egg gives to the larva; and it does not think of using these germs by developing them. It persists in hopping, with no further ambition; it is satisfied to go on foot, to remain a Pedestrian Locust, as the nomenclators call it, when it

might, one would think, acquire wings, that higher mechanism of locomotion.

Rapid flitting from crest to crest, over the valleys deep in snow; easy flight from a shorn pasture to one not yet exploited: can these be negligible advantages to the Pedestrian Locust? Obviously not. The other Acridians and in particular his fellow-dwellers on the mountain-tops possess wings and are all the better for them. What is his reason for not doing as they do? It would be very profitable to extract from their sheaths the sails which he keeps packed away in useless stumps; and he does not do it. Why?

"Arrested development," says some one. Very well. Life is arrested half-way through its work; the insect does not attain the ultimate form of which it bears the emblem. For all its scientific turn of phrase, the reply is not really a reply at all. The question returns under another guise: what causes that arrested development?

The larva is born with the hope of flying at maturity. As a pledge of that fair future, it carries on its back four sheaths in which the precious germs lie slumbering. Everything is arranged according to the rules of

normal evolution. Thereupon, suddenly, the organism does not fulfil its promises; it is false to its engagements; it leaves the adult insect without sails, leaves it with only useless rags.

Are we to lay this nudity to the charge of the harsh conditions of Alpine life? Not at all, for the other hoppers, living on the same grassy slopes, manage very well to achieve the wings foretold by the larva's rudiments.

Men tell us that, from one attempt to another, from progress to progress, under the stimulus of necessity, animals end by acquiring this or that organ. No other creative intervention is accepted than that of need. This, for instance, is the way in which the Locusts went to work, in particular those whom I see fluttering over the ridges of the Ventoux. From their niggardly larval flaps they are supposed to have extracted wings and wing-cases, by virtue of secret and mysterious labours rendered fruitful by the centuries.

Very well, O my illustrious masters! And now tell me, if you please, what reasons persuaded the Pedestrian Locust not to go beyond his rude outline of a flying-apparatus.

He also, surely, must have felt the prick of necessity for ages and ages; during his laborious tumbles amid the broken stones, he must have felt the advantage that it would be for him to be relieved of his weight by means of wing-power; and all the endeavours of his organism, striving to achieve a better lot, have not yet succeeded in spreading bladewise his incipient wings.

If we accept your theories, under the same conditions of urgent necessity, diet, climate and habits, some are successful and manage to fly, others fail and remain clumsy pedestrians. Short of resting satisfied with words and passing off chalk for cheese, I abandon the explanations offered. Sheer ignorance is far preferable, for it prejudges nothing.

But let us leave this backward one who is a stage behind his kinsmen, no one knows why. Anatomy has its throwbacks, its halts, its sudden leaps, all of which defy our curiosity. In the presence of the unfathomable problem of origins, the best thing is to bow in all humility and pass on.

CHAPTER XVIII

THE LOCUSTS: THEIR EGGS

WHAT can our Locusts do? Not much in the way of manufactures. Their business in the world is that of alchemists who in their gourdlike stomach elaborate and refine material destined for higher objects. As I sit by my fireside, in the evening hours of meditation, scribbling these notes upon the part which Locusts play in life, I am not prepared to say that they have not contributed from time to time to the awakening of thought, that magic mirror of things. They are on the earth to thrive as best they can and to multiply, the latter being the highest law of animals charged with the manufacture of foodstuffs.

From the former point of view, if we except the all-devouring tribes which at times imperil the very existence of Africa, the Locusts hardly attract our attention. They are poor trenchermen; and I can surfeit a whole

barrack-room in my cages with a leaf of lettuce. As for the way in which they multiply, that is another matter and one well worth a moment's attention.

At the same time we must not look for the nuptial eccentricities of the Grasshoppers. Despite close similarity of structure, we are here in a new world as regards habits and character. In the peaceful Locust clan, all that has to do with pairing is correct, free from impropriety and conducted in accordance with the customary rites of the entomological world. Any one keeping it under observation at the time of the procreative frenzy will realize that the Locust came later than the Grasshopper, after the primitive Orthopteron had sown his monstrous wild oats. There is nothing striking to be said therefore on this always delicate subject; and I am very glad of it. Let us pass on and come to the eggs.

At the end of August, a little before noonday, let us keep a close watch on the Italian Locust (*Caloptenus italicus,* LIN.), the boldest hopper of my neighbourhood. He is a sturdy fellow, very free with his kicks; and he is clad in short wing-cases that hardly reach the tip of his abdomen. His costume

is usually russet, with brown patches. A few more elegant ones edge the corselet with a whitish hem which is prolonged over the head and wing-cases. The wings are colourless except at the base, where they are pink; the hinder shins are claret-coloured.

The mother selects a suitable spot for her eggs on the side where the sun is hottest and always at the edge of the cage, whose wire-work supplies her with a support in case of need. Slowly and laboriously she drives her clumsy drill perpendicularly into the sand, this drill being her abdomen, which disappears entirely. In the absence of proper boring-tools, the descent underground is painful and hesitating, but is at last accomplished thanks to perseverance, that powerful lever of the weak.

The mother is now installed, half-buried in the soil. She gives slight starts, which follow one another at regular intervals and seem to correspond with the efforts of the oviduct as it expels the eggs. The neck gives throbs that lift and lower the head with slight jerks. Apart from these pulsations of the head, the body, in its only visible half, the fore-part, is absolutely stationary, so intense is the creature's absorption in her

laying. It is not unusual for a male, by comparison a dwarf, to come near and for a long time to gaze curiously at the travailing mother. Sometimes also a few females stand around, with their big faces turned towards their friend in labour. They seem to take an interest in what is happening, perhaps saying to themselves that it will be their turn soon.

After some forty minutes of immobility, the mother suddenly releases herself and bounds far away. She gives not a look at the eggs nor a touch of the broom to conceal the aperture of the well. The hole closes of its own accord, as best it can, by the natural falling-in of the sand. It is an extremely summary performance, marked by an utter absence of maternal solicitude. The Locust mother is not a model of affection.

Others do not forsake their eggs so recklessly. I can name the ordinary Locust with the blue wings striped with black (*Œdipoda cærulescens,* Lin.); also *Pachytylus nigrofasciatus,* De Geer, whose *cognomen* lacks point, for it ought to suggest either the malachite-green patches of the costume or the white cross of the corselet.

Both, when laying their eggs, adopt the

same attitude as the Italian Locust. The abdomen is driven perpendicularly into the soil; the rest of the body partly disappears under the sliding sand. We again see a long period of immobility, exceeding half an hour, together with little jerks of the head, a sign of the underground efforts.

The two mothers at last release themselves. With their hind-legs, lifted on high, they sweep a little sand over the orifice of the pit and press it down by stamping rapidly. It is a pretty sight to watch the precipitous action of their slender legs, blue or pink, giving alternate kicks to the opening which is waiting to be plugged. In this manner, with a lively trampling, the entrance to the house is closed and hidden away. The hole in which the eggs were laid disappears from sight, so well obliterated that no evil-intentioned creature could hope to discover it by means of vision alone.

Nor is this all. The driving-power of the two rammers is the hinder thighs, which, in rising and falling, scrape lightly against the edge of the wing-cases. This bow-play produces a faint stridulation, similar to that with which the insect placidly lulls itself to sleep in the sun.

The Hen salutes the egg which she has just laid with a song of gladness; she announces her maternal joys, to the whole neighbourhood. Even so does the Locust do in many cases. With her thin scraper, she celebrates the advent of her family. She says:

"*Non omnis moriar;* I have buried underground the treasure of the future; I have entrusted to the incubation of the great hatcher a keg of germs which will take my place."

Everything on the site of the nest is put right in one brief spell of work. The mother then leaves the spot, refreshes herself after her exertions with a few mouthfuls of green stuff and prepares to begin again.

The largest of the Acridians in our part of the country, the Grey Locust (*Pachytylus cinerescens,* FABR.), rivals the African Locusts in size, without possessing their calamitous habits. He is peace-loving and temperate and above reproach where the fruits of the earth are concerned. From him we obtain a little information which is easily verified by observing the insect in captivity.

The eggs are laid about the end of April, a few days after the pairing, which lasts

some little while. The female is armed at the tip of the abdomen—as, in varying degrees, are the other Locust mothers—with four short excavators, arranged in pairs and shaped like a hooked finger-nail. In the upper pair, which are larger, these hooks are turned upwards; in the lower and smaller pair, they are turned downwards. They form a sort of claw and are hard and black at the point; also they are scooped out slightly, like a spoon, on their concave surface. These are the pick-axes, the trepans, the boring-tools.

The mother bends her long abdomen perpendicularly to the line of the body. With her four trepans she bites into the soil, lifting the dry earth a little; then, with a very slow movement, she pushes down her abdomen, making no apparent effort, displaying no excitement that would reveal the difficulty of the task.

The insect is motionless and contemplative. The boring-implement could not work more quietly if it were sinking into soft mould. It might all be happening in butter; and yet what the bore traverses is caked, unyielding earth.

It would be interesting, if it were only pos-

sible, to see the perforating-tool, the four gimlets, at work. Unfortunately, things happen in the mysteries of the earth. No rubbish rises to the surface; nothing denotes the underground labour. Little by little the abdomen sinks softly in, as our finger would sink into a lump of soft clay. The four trepans must open the passage, crumbling the earth into dust which is thrust back sideways by the abdomen and packed as with a gardener's dibble.

The best site for laying the eggs is not always found at the first endeavour. I have seen the mother drive her abdomen right in and make five wells one after the other before finding a suitable place. The pits recognized as defective are abandoned as soon as bored. They are vertical, cylindrical holes, of the diameter of a thick lead-pencil and astonishingly neat. No wimble would produce cleaner work. Their length is that of the insect's abdomen, distended as far as the extension of the segments allows.

At the sixth attempt, the spot is recognized as propitious. The laying thereupon takes place, but nothing outside betrays the fact, so motionless does the mother seem, with her abdomen immersed up to the hilt, which

causes the long wings lying on the ground to rumple and open out. The operation lasts for a good hour.

At last the abdomen rises, little by little. It is now near the surface, in a favourable position for observation. The valves are in continual movement, whipping a mucus which sets in milk-white foam. It is very similar to the work done by the Mantis when enveloping her eggs in froth.

The foamy matter forms a nipple at the entrance to the well, a knob which stands well up and attracts the eye by the whiteness of its colour against the grey background of the soil. It is soft and sticky, but hardens pretty soon. When this closing button is finished, the mother moves away and troubles no more about her eggs, of which she lays a fresh batch elsewhere after a few days have intervened.

At other times, the terminal foamy paste does not reach the surface; it stops some way down and, before long, is covered with the sand that slips from the margin. There is then nothing outside to mark the place where the eggs were laid.

Even when they concealed the mouth of the well under a layer of swept sand, my

various captives, large and small, were too assiduously watched by me to foil my curiosity. I know in every case the exact spot where the barrel of eggs lies. The time has come to inspect it.

The thing is easily discovered, an inch or an inch and a half down, with the point of a knife. Its shape varies a good deal in the different species, but the fundamental structure remains the same. It is always a sheath made of solidified foam, a similar foam to that of the nests of the Praying Mantis. Grains of sand stuck together give it a rough outer covering.

The mother has not actually made this coarse cover, which constitutes a defensive wall. The mineral wrapper results from the simple infiltration of the product, at first semifluid and viscous, that accompanies the emission of the eggs. The wall of the pocket absorbs it and, swiftly hardening, becomes a cemented scabbard, without the agency of any special labour on the insect's part.

Inside, there is no foreign matter, nothing but foam and eggs. The latter occupy only the lower portion, where they are immersed in a frothy matrix and packed one on top

of the other, slantwise. The upper portion, which is larger in some cases than in others, consists solely of soft, yielding foam. Because of the part which it plays when the young larvæ come into existence, I shall call it the ascending-shaft. A final point worthy of observation is that all the sheaths are planted more or less vertically in the soil and end at the top almost level with the ground.

We will now describe specifically the layings which we find in the cages. That of *Pachytylus cinerescens* is a cylinder six centimetres long and eight millimetres wide.[1] The upper end, when it emerges above the ground, swells into a nipple. All the rest is of uniform thickness. The yellow-grey eggs are fusiform. Immersed in the froth and arranged slantwise, they occupy only about a sixth part of the total length. The rest of the structure is a fine, white, very powdery foam, soiled on the outside by grains of earth. The eggs are not many in number, about thirty; but the mother lays several batches.

That of *P. nigrofasciatus* is shaped like a slightly curved cylinder, rounded off at the

[1] 2.34 by .312 inches.—*Translator's Note.*

lower end and cut square at the upper end. Its dimensions are an inch to an inch and a half in length by a fifth of an inch in width. The eggs, about twenty in number, are orange-red, adorned with a pretty pattern of tiny spots. The frothy matrix in which they are contained is small in quantity; but above them there is a long column of very fine, transparent and porous foam.

The Blue-winged Locust (*Œdipoda cœrulescens*) arranges her eggs in a sort of fat inverted comma. The lower portion contains the eggs in its gourd-shaped pocket. They also are few in number, some thirty at most, of a fairly bright orange-red, but unspotted. This receptable is crowned with a curved, conical cap of foam.

The lover of the mountain-tops, the Pedestrian Locust, adopts the same method as the Blue-winged Locust, the denizen of the plains. Her sheath too is shaped like a comma with the point turned upwards. The eggs, numbering about two dozen, are dark-russet and are strikingly ornamented with a delicate lacework of inwrought spots. You are quite surprised when you pass the magnifying-glass over this unexpected elegance. Beauty leaves its impress everywhere, even

in the humble covering of an unsightly Acridian incapable of flight.

The Italian Locust begins by enclosing her eggs in a keg and then, when on the point of sealing her receptacle, thinks better of it: something essential, the ascending-shaft, is lacking. At the upper end, at the point where it seems as if the barrel ought to finish and close, a sudden compression changes the course of the work, which is prolonged by the regulation foamy appendage. In this way, two storeys are obtained, clearly defined on the outside by a deep groove. The lower, which is oval in shape, contains the packet of eggs; the upper, tapering into the tail of a comma, consists of nothing but foam. The two communicate by an opening that remains more or less free.

The Locust's art is not confined to these specimens of architecture. She knows how to construct other strong-boxes for her eggs; she can protect them with all kinds of edifices, some simple, others more ingenious, but all worthy of our attention. Those with which we are familiar are very few compared with those of which we are ignorant. No matter: what the cages reveal to us is sufficient to enlighten us as to the general form. It re-

mains for us to learn how the building—an egg-warehouse below, a foamy turret above —is constructed.

Direct observation is impracticable here. If we took it into our heads to dig and to uncover the abdomen at work, the mother, worried by our importunity, would leap away without telling us anything. Fortunately, one Locust, the strangest of my district, reveals the secret to us. I speak of the Tryxalis, the largest member of the family, after the Grey Locust.

Though inferior to the last-named in size, how far she exceeds her in slenderness of figure and, above all, in originality of shape! On our sun-scorched swards, none has a leaping-apparatus to compare with hers. What hind-legs, what extravagant thighs, what shanks! They are longer than the creature's whole body.

The result obtained hardly corresponds with this extraordinary length of limb. The insect shuffles awkwardly along the edges of the vines, on the sand sparsely covered with grass; it seems embarrassed by its shanks, which are slow to work. With this equipment, weakened by its excessive length, the leap is awkward, describing but a short

parabola. The flight alone, once taken, is of a certain range, thanks to an excellent pair of wings.

And then what a strange head! It is an elongated cone, a sugar-loaf, whose point, turned up in the air, has earned for the insect the quaint epithet of *nasuta,* long-nosed. At the top of this cranial promontory are two large, gleaming, oval eyes and two antennæ, flat and pointed, like dagger-blades. These rapiers are organs of information. The Tryxalis lowers them, with a sudden swoop, to explore with their points the object in which she is interested, the bit which she intends to nibble.

To this abnormal shape we must add another characteristic that makes this long-shanks an exception among Acridians. The ordinary Locusts, a peaceful tribe, live among themselves without strife, even when driven by hunger. The Tryxalis, on the other hand, is somewhat addicted to the cannibalism of the Grasshoppers. In my cages, in the midst of plenty, she varies her diet and passes easily from salad to game. When tired of green stuff, she does not scruple to exercise her jaws on her weaker companions.

This is the creature capable of giving us

information about methods of laying. In my cages, as the result of an aberration due no doubt to the boredom of captivity, it has never laid its eggs in the ground. I have always seen it operating in the open air and even perched on high.[1] In the early days of October, the insect clings to the trelliswork of the cage and very slowly discharges its batch of eggs, which we see gushing forth in a fine, foamy stream, soon stiffening into a thick cylindrical cord, knotty and queerly curved. It takes nearly an hour to complete the emission. Then the thing falls to the ground, no matter where, unheeded by the mother, who never troubles about it again.

The shapeless object, which varies greatly in different layings, is at first straw-coloured, then darkens and turns rusty-brown on the morrow. The fore-part, which is the first ejected, usually consists only of foam; the hinder part alone is fertile and contains the eggs, buried in a frothy matrix. They are amber-yellow, about a score in number and shaped like blunt spindles, eight to nine millimetres in length.[2]

[1] The big Grey Locust is sometimes subject to the same aberration.—*Author's Note.*

[2] .312 to .351 inch.—*Translator's Note.*

The sterile end, which is at least as big as the other, tells us that the apparatus which produces the foam is in operation before the oviduct and afterwards goes on while the latter is working.

By what mechanism does the Tryxalis froth up her viscous product into a porous column first and a mattress for the eggs afterwards? She must certainly know the method of the Praying Mantis, who, with the aid of spoon-shaped valves, whips and beats her glair and converts it into an *omelette soufflée;* but in the Acridian's case the frothing is done within and there is nothing outside to betray its existence. The glue is foamy from the moment of its appearing in the open air.

In the Mantis' building, that complex work of art, it is not a case of any special talent, which the mother can exercise at will. The wonderful egg-casket comes from the ordinary action of the mechanism, is merely the outcome of the organization. *A fortiori,* the Tryxalis, in discharging her clumsy sausage, is purely a machine. The thing happens of itself.

The same applies to the Locusts. They have no industry of their own specially de-

vised for laying eggs in strata in a keg of froth and extending this keg into an ascending-shaft. The mother, with her abdomen plunged into the sand, expels at the same time eggs and foamy glair. The whole becomes coordinated of its own accord simply by the mechanism of the organs: on the outside, the frothy material, which coagulates and becomes encrusted with a bulwark of earth; in the centre and at the bottom, the eggs arranged in regular strata; at the upper end, a column of yielding foam.

The Tryxalis and the Grey Locust are early hatchers. The latter's family are already hopping on the yellow patches of grass in August; before October is out, we are frequently coming across young larvæ with pointed skulls. But in most of the other Acridians the ovigerous sheaths last through the winter and do not open until the fine weather returns. They are buried at no great depth in a soil which is at first loose and dusty and which would not be likely to interfere with the emergence of the young larvæ if it remained as it is; but the winter rains cake it together and turn it into a hard ceiling. Suppose that the hatching takes place only a couple of inches down: how is

this crust to be broken, how is the larva to come up from below? The mother's unconscious art has provided for that.

The Locust at his birth finds above him, not rough sand and hardened earth, but a perpendicular tunnel whose solid walls keep all difficulties at a distance, a road protected by a little easily-penetrated foam, an ascending-shaft, in short, which brings the new-born larva quite close to the surface. Here a finger's-breadth of serious obstacle remains to be overcome.

The greater part of the emergence therefore is accomplished without effort, thanks to the terminal appendage of the egg-barrel. If, in my desire to follow the underground work of the exodus, I experiment in glass tubes, almost all the new-born larvæ die, exhausted with fatigue, under an inch of earth, when I do away with the liberating appendage to the shells. They duly come to light if I leave the nest in its integral condition, with the ascending-shaft pointing upwards. Though a mechanical product of the organism, created without any effort of the creature's intelligence, the Locust's edifice, we must confess, is singularly well thought out.

Having come quite close to the surface with the aid of his ascending-shaft, what does the young Locust do to complete his deliverance? He has still to pass through a layer of earth about a finger's-breadth in thickness; and that is very hard work for budding flesh.

If we keep the egg-cases in glass tubes during the favourable period, the end of spring, we shall receive a reply to our question, provided that we have the requisite patience. The Blue-winged Locusts lend themselves best to my investigations. I find some of them busied with the work of liberation at the end of June.

The little Locust, on leaving his shell, is a whitish colour, clouded with light red. His progress is made by wormlike movements; and, so that it may be impeded as little as possible, he is hatched in the condition of a mummy, that is to say, clad, like the young Grasshoppers, in a temporary jacket, which keeps his antennæ, palpi and legs closely fixed to his breast and belly. The head itself is very much bent. The large hind-thighs are arranged side by side with the folded shanks, shapeless as yet, short and as it were crooked. On the way, the

legs are slightly released; the hind-legs are straightened out and afford a fulcrum for the sapping-work.

The boring-tool, a repetition of the Grasshoppers', is at the neck. There is here a tumour that swells, subsides, throbs and strikes the obstacle with pistonlike regularity. A tiny and most tender cervical bladder engages in a struggle with quartz. At the sight of this capsule of glair striving to overcome the hardness of the mineral, I am seized with pity. I come to the unhappy creature's assistance by slightly damping the layer to be passed through.

Despite my intervention, the task is so arduous that, in an hour, I see the indefatigable one make a progress of hardly a twenty-fifth of an inch. How you must labour, you poor little thing, how you must persevere with your throbbing head and writhing loins, before you can clear a passage for yourself through the thin layer which my kindly drop of water has softened for you!

The ineffectual efforts of the tiny mite tell us plainly that the emergence into the light of day is an enormous undertaking, in which, but for the aid of the exit-tunnel, the

mother's work, the greater number would succumb.

It is true that the Grasshoppers, similarly equipped, find it even more difficult to make their way out of the earth. Their eggs are laid naked in the ground; no outward passage is prepared for them beforehand. We may assume, therefore, that the mortality must be very high among these improvident ones; legions are bound to perish at the time of the exodus.

This is confirmed by the comparative scarcity of Grasshoppers and the extreme abundance of Locusts. And yet the number of eggs laid is about the same in both cases. The Locust does not, in fact, limit herself to a single casket containing a score of eggs: she puts into the ground two, three and more, which gives a total population approaching that of the Decticus and other Grasshoppers. If, to the greater delight of the consumers of small game, she thrives so well, whereas the Grasshopper, who is quite as fertile but less ingenious, dwindles, does she not owe it to that superb invention, her exit-turret?

One last word upon the tiny insect which, for days on end, fights away with its cervical

rammer. It is outside at last and rests for a moment, to recover from all that fatigue. Then, suddenly, under the thrust of the throbbing blister, the temporary jacket splits. The rags are pushed back by the hind-legs, which are the last to strip. The thing is done: the creature is free, pale in colouring as yet, but possessing the final larval form.

Then and there, the hind-legs, hitherto stretched in a straight line, adopt the regulation position; the legs fold under the great thighs; and the spring is ready to work. It works. Little Locust makes his entrance into the world and hops for the first time. I offer him a bit of lettuce the size of my finger-nail. He refuses. Before taking nourishment, he must first mature and develop for a while in the sun.

CHAPTER XIX

THE LOCUSTS: THE LAST MOULT

I HAVE just beheld a stirring sight: the last moult of a Locust, the extraction of the adult from his larval wrapper. It is magnificent. The object of my enthusiasm is the Grey Locust, the giant among our Acridians, who is common on the vines at vintage-time, in September. On account of his size—he is as long as my finger—he is a better subject for observation than any other of his tribe.

The fat, ungraceful larva, a rough draft of the perfect insect, is usually pale-green; but some also are bluish-green, dirty-yellow, red-brown or even ashen-grey, like the grey of the adult. The corselet is strongly keeled and notched, with a sprinkling of fine white worm-holes. The hind-legs, powerful as those of mature age, have a great haunch striped with red and a long shank shaped like a two-edged saw.

The wing-cases, which in a few days will project well beyond the tip of the abdomen, are in their present state two skimpy, triangular pinions, touching back to back along their upper edges and continuing the keel of the corselet. Their free ends stand up like a pointed gable. These two coat-tails, of which the material seems to have been clipped short with ridiculous meanness, just cover the creature's nakedness at the small of the back. They shelter two lean strips, the germs of the wings, which are even more exiguous. In brief, the sumptuous, slender sails of the near future are at present sheer rags, of such meagre dimensions as to be grotesque. What will come out of these miserable envelopes? A marvel of stately elegance.

Let us observe the proceedings in detail. Feeling itself ripe for transformation, the creature clutches the trelliswork of the cage with its hinder and intermediary legs. The fore-legs are folded and crossed over the breast and are not employed in supporting the insect, which hangs in a reversed position, back downwards. The triangular pinions, the sheaths of the wing-cases, open their peaked roof and separate sideways; the two

narrow strips, the germs of the wings, stand in the centre of the uncovered space and diverge slightly. The position for the moult has now been taken with the necessary stability.

The first thing to be done is to burst the old tunic. Behind the corselet, under the pointed roof of the prothorax, pulsations are produced by alternate inflation and deflation. A similar operation is performed in front of the neck and probably also under the entire covering of the shell that is to be split. The delicacy of the membranes at the joints enables us to perceive what is going on at these bare points, but the harness of the corselet hides it from us in the central portion.

It is there that the insect's reserves of blood flow in waves. The rising tide expresses itself in blows of an hydraulic battering-ram. Distended by this rush of humours, by this injection wherein the organism concentrates its energies, the skin at last splits along a line of least resistance prepared by life's subtle previsions. The fissure yawns all along the corselet, opening precisely over the keel, as though the two symmetrical halves had been soldered. Un-

breakable any elsewhere, the wrapper yields at this median point which is kept weaker than the rest. The split is continued some little way back and runs between the fastenings of the wings; it goes up the head as far as the base of the antennæ, where it sends a short ramification to the right and left.

Through this break the back is seen, quite soft, pale, hardly tinged with grey. Slowly it swells into a larger and larger hunch. At last it is wholly released. The head follows, extracted from its mask, which remains in its place, intact in the smallest particular, but looking strange with its great glassy eyes that do not see. The sheaths of the antennæ, with not a wrinkle, with nothing out of order and with their normal position unchanged, hang over this dead face, which is now translucent.

Therefore, in emerging from their narrow sheaths, which enclosed them with such absolute precision, the antennary threads encountered no resistance capable of turning their scabbards inside out, or disturbing their shape, or even wrinkling them. Without injuring the twisted containers, the contents, equal in size and themselves twisted, have managed to slip out as easily as a smooth,

straight object would do, if sliding in a loose sheath. The extraction-mechanism will be still more remarkable in the case of the hind-legs.

Meanwhile it is the turn of the fore-legs and then of the intermediary legs to shed armlets and gauntlets, always without the least rent, however small, without a crease of rumpled material, without a trace of any change in the natural position. The insect is now fixed to the top of the cage only by the claws of the long hind-legs. It hangs perpendicularly, head downwards, swinging like a pendulum, if I touch the wire-gauze. Four tiny hooks are what it hangs by. If they gave way, if they became unfastened, the insect would be lost, for it is incapable of unfurling its enormous wings anywhere except in space. But they will hold: life, before withdrawing from them, left them stiff and solid, so as to be able firmly to support the struggles that are to follow.

The wing-cases and wings now emerge. These are four narrow strips, faintly grooved and looking like bits of paper ribbon. At this stage, they are scarcely a quarter of their final length. So limp are they that they bend under their own weight

and sprawl along the insect's sides in the opposite direction to the normal. Their free end, which should be turned backwards, now points towards the head of the Locust, who is hanging upside down. Imagine four blades of thick grass, bent and battered by a rainstorm, and you will have a fair picture of the pitiable bunch formed by the future organs of flight.

It must be no light task to bring things to the requisite stage of perfection. The deeper-seated changes are already well-started, solidifying liquid mucilages, bringing order out of chaos; but so far nothing outside betrays what is happening in that mysterious laboratory where everything seems lifeless.

Meanwhile, the hind-legs become released. The great thighs appear in view, tinted on their inner surface with a pale pink, which will soon turn into a streak of bright crimson. The emergence is easy, the bulky haunch clearing the way for the tapering knuckle.

It is different with the shank. This, in the adult insect, bristles throughout its length with a double row of hard, pointed spikes. Moreover, the lower extremity ends in four large spurs. It is a genuine saw, but

with two parallel sets of teeth and so powerful that, if we dismiss the size from our minds, it might be compared with the rough saw wielded by a quarryman.

The larva's shin is similarly constructed, so that the object to be extracted is contained in a sheath as awkwardly shaped as itself. Each spur is enclosed in a similar spur, each tooth fits into the hollow of a similar tooth; and the moulding is so exact that we should obtain no more intimate contact if, instead of the envelope waiting to be shed, we coated the limb with a layer of varnish distributed uniformly with a fine brush.

Nevertheless the sawlike tibia slips out of its long, narrow case without catching in it at any point whatever. If I had not seen this happen over and over again, I could never have believed it: the discarded legging is quite intact all the way down. Neither the terminal spurs nor the two rows of spikes have caught in the delicate mould. The saw has respected the dainty scabbard which a puff of my breath is enough to tear; the formidable rake has slipped through without leaving the least scratch behind it.

I was far from expecting such a result as

this. Because of the spiked armour, I imagined that the leg would strip in scales which came loose of themselves or yielded to rubbing, like dead cuticle. How greatly did the reality exceed my expectations!

From the spurs and spikes of the infinitely thin matrix there emerge spurs and spikes that make the leg capable of cutting soft wood. This is done without violence or the least inconvenience; and the discarded garment remains where it is, hanging by the claws to the top of the cage, uncreased and untorn. The magnifying-glass shows not a trace of rough usage. As the thing was before the excoriation, so it remains afterwards. The legging of dead skin continues, down to the pettiest details, an exact replica of the live leg.

If any one suggested that we should extract a saw from some sort of goldbeater's-skin sheath which had been exactly moulded on the steel and that we should perform the operation without producing the least tear, we should burst out laughing: the thing is so flagrantly impossible. Life makes light of these impossibilities; it has methods of realizing the absurd, in case of need. And the Locust's leg tells us so.

If the saw of the shin were as hard as it is once it leaves its sheath, it would absolutely refuse to come out without tearing to pieces the tight-fitting scabbard. The difficulty therefore is evaded, for it is essential that the leggings, which form the only suspension-cords, should remain intact in order to furnish a firm support until the deliverance is completed.

The leg in process of liberation is not a limb fit for walking; it has not the rigidity which it will presently possess. It is soft and highly flexible. In the portion which the progress of the moult exposes to view, I see it bending and curving as I wish, under the mere influence of its own weight, when I lift the cage. It is as supple as elastic cord. And yet consolidation follows very rapidly, for the proper stiffness will be acquired in a few minutes.

Farther on, in the part hidden from me by the sheath, the leg is certainly softer and in a state of exquisite plasticity—I was almost saying fluidity—which allows it to overcome difficult passages almost as a liquid would flow.

The teeth of the saw are there, but have none of their future sharpness. I am able

to strip a leg partially with the point of a knife and to extract the spines from their horny mould. They are germs of spikes, flexible buds which bend under the slightest pressure and resume their upright position as soon as the pressure is removed.

These spikes lie backwards when the leg is about to be drawn out; they stand up again and solidify while it emerges. I am witnessing not the mere stripping of gaiters from limbs completely enclosed, but rather a sort of birth and growth which disconcert us by their rapidity.

Much in the same way, but with far less delicate precision, do the claws of the Crayfish, at moulting-time, withdraw the soft flesh of their two fingers from the old stony sheath.

The shanks are free at last. They are folded limply in the groove of the thigh, there to mature without moving. The abdomen is next stripped. Its fine tunic wrinkles, rumples and pushes back towards the extremity, which alone for some time longer remains clad in the moulting skin. Except at this point, the whole of the Locust is now bare.

It is hanging perpendicularly, head down,

supported by the claws of the now empty leggings. Throughout this long and finikin work, the four talons have never yielded, thanks to the delicacy and care with which the extraction has been conducted.

The insect, fixed by the stern to its cast skin, does not move. Its abdomen is immensely swollen, apparently distended by the reserve of organizable humours which the expansion of the wings and wing-cases will soon set in motion. The Locust is resting; he is recovering from his exertions. Twenty minutes are spent in waiting.

Then, by an effort of its back, the hanging insect raises itself and with its front tarsi grabs hold of the cast skin fastened above it. Never did acrobat, swinging by his feet from the bar of a trapeze, display greater strength of loin in lifting himself. When this feat is accomplished, what remains to be done is nothing. With the support which he has now gripped, the Locust climbs a little higher and reaches the wire gauze of the cage. This takes the place of the brushwood which the free insect would utilize for the transformation. He fixes himself to it with his four front feet. Then the tip of the abdomen succeeds in releasing itself,

whereupon, loosened with one last shake, the empty husk drops to the ground.

The fact of its falling interests me, for I remember the stubborn persistency with which the Cicada's cast skin defies the winter winds without being detached from its supporting twig. The Locust's transfiguration is conducted in much the same way as the Cicada's. Then how is it that the Acridian gives himself such very shaky hangers? The hooks hold so long as the work of tearing continues, though one would think that this ought to bring down everything; they give way under a trifling shock so soon as that work is done. We have, therefore, a very unstable condition of equilibrium here, showing once more with what delicate precision the insect leaves its sheath.

I said "tearing," for want of a better word. But it is not quite that. The term implies violence; and violence there cannot be any, because of the unsteady balance. Should the Locust, upset by his exertions, come to the ground, it would be all up with him. He would shrivel where he lies; or, at any rate, his organs of flight, being unable to expand, would remain pitiful shreds. The Locust does not tear himself loose; he

flows softly from his scabbard. It is as though he were forced out by a gentle spring.

To return to the wings and wing-cases, which have made no apparent progress since leaving the sheaths. They are still stumps, with fine longitudinal seams, not much more than bits of rope. Their expansion, which will take more than three hours, is reserved for the end, when the insect is completely stripped and in its normal position.

We have seen the Locust turn head uppermost. This upright position is enough to restore the natural arrangement of the wing-cases and wings. Being extremely flexible and bent by their own weight, they were hanging down with their loose end pointing towards the head of the inverted insect. Now, still by virtue of their own weight, they are straightened and put the right way up. They are no longer curved like the petals of a flower, they are no longer in an inverted position; but they still look miserably insignificant.

In its perfect state, the wing is fan-shaped. A radiating cluster of strong nervures runs through it lengthwise and forms the framework of the fan, which is readily furled or

unfurled. The intervening spaces are crossed by innumerable tiny bars which make of the whole a network of rectangular meshes. The wing-case, which is coarser and much less expanded, repeats this structure in squares.

In neither case does any of the mesh show during the rope's-end stage. All that we see is a few wrinkles, a few winding furrows, which tell us that the stumps are bundles of cunningly folded material reduced to their smallest volume.

The expansion begins near the shoulder. Where at first nothing definite was to be distinguished, we soon see a diaphanous area subdivided into meshes of exquisite precision. Little by little, with a slowness that defies observation even through the magnifying-glass, this area increases in extent at the expense of the shapeless terminal roll. My eyes linger in vain on the confines of the two portions, the roll developing and the gauze already developed: I see nothing, see no more than I should see in a sheet of water. But wait a moment; and the tissue of squares stands out with perfect clearness.

If we judged only by this first examination, we should really think that an organ-

izable fluid is abruptly congealing into a network of nervures; we should imagine that we were in the presence of a crystallization similar, in its suddenness, to that of a saline solution on the slide of a microscope. Well, no: things cannot be actually happening like that. Life does not perform its tasks so hastily.

I detach a half-developed wing and turn the powerful eye of the microscope upon it. This time I am satisfied. On the confines where the network seemed to be gradually woven, that network was really in existence. I can plainly see the longitudinal nervures, already thick and strong; and I can also see, pale, it is true, and without relief, the cross-bars. I find them all in the terminal roll, of which I succeed in unfolding a few strips.

It is obvious. The wing is not at this moment a fabric on the loom, through which the procreative energies are driving their shuttle; it is a fabric already completed. All that it lacks to be perfect is expansion and stiffness, even as our linen needs only starching and ironing.

The flattening out is finished in three hours or more. The wings and wing-cases stand up on the Locust's back like a huge set of

sails, sometimes colourless, sometimes pale-green, as are the Cicada's wings at the beginning. We are amazed at their size when we think of the paltry bundles that represented them at first. How did so much stuff manage to find room there!

The fairy-tales tell us of a grain of hempseed that contained the underlinen of a princess. Here is a grain that is even more astonishing. The one in the story took years and years to sprout and multiply and at last to yield the quantity of hemp required for the trousseau; the Locust's supplies a sumptuous set of sails in a short space of time.

Slowly the proud crest, standing erect in four straight blades, acquires consistency and colour. The latter turns the requisite shade on the following day. For the first time the wings fold like a fan and lie in their places; the wing-cases lower their outer edge and form a gutter which falls over the sides. The transformation is finished. All that remains for the big Locust to do is to harden his tissues still further and to darken the grey of his costume while revelling in the sun. Let us leave him to enjoy himself and retrace our steps a little.

The four stumps, which issued from their sheaths shortly after the corselet split its keel down the middle, contain, as we have seen, the wings and wing-cases, with their network of nervures. This network, if not perfect, has at least the general plan of its numberless details mapped out. To unfurl these poor bundles and convert them into generous sails, it is enough that the organism, acting in this case like a forcing-pump, should shoot a stream of humours, which have been kept in reserve for this moment, the hardest of all, into the little channels already prepared for their reception. With the channel marked out in advance, a slight injection is sufficient to explain the rapid spread.

But what were the four strips of gauze while still contained in their sheaths? Are the wings spatules and the three-cornered pinions of the larva moulds whose creases, corners and sinuosities shape their contents in their own image and weave the tissues of the future wing and wing-case? If we had to do with a real instance of moulding, our brains could call a halt. We should say to ourselves that it was quite simple for the thing moulded to correspond with the shape

of the mould. But our halt would be short-lived, for the mould in its turn would want explaining: we should have to seek for a solution of its infinite intricacies. Let us not go so far back; we should be utterly in the dark. Let us rather keep to facts that can be observed.

I examine through the magnifying-glass a pinion of a larva ripe for transformation. I see a bundle of fairly thick nervures radiating fanwise. Other nervures, paler and finer, are set in the intermediate spaces. Lastly, the fabric is completed by a number of very short transversal lines, more delicate still and chevron-shaped.

This, no doubt, gives a rough outline of the future wing-case; but how different from the mature structure! The arrangement of the radiating nervures, the skeleton of the edifice, is not at all the same; the network formed by the transversal veins in no way suggests the complicated pattern which we shall see later. The rudimentary is about to be succeeded by the infinitely complex, the crude by the exquisitely perfect. The same remark applies to the wing-spatule and its outcome, the final wing.

It is quite evident, when we have the pre-

paratory and the ultimate stage before our eyes at the same time: the larva's pinion is not merely a mould which elaborates the material in its own image and shapes the wing-case upon the model of its hollow. No, the membrane which we are expecting is not yet inside in the form of a bundle which, when unfurled, will astonish us with the size and the extreme complexity of its texture. Or, to be accurate, it is there, but in a potential state. Before becoming a real thing, it is a virtual thing, which is nothing as yet, but which is capable of becoming something. It is there just as much as the oak is inside its acorn.

A fine, transparent rim binds the free edge both of the embryo wing and the embryo wing-case. Under a powerful lens we can see a few uncertain outlines of the future lacework. This might well be the factory in which life intends to set its materials going. There is nothing else visible, nothing to suggest the prodigious network whose every mesh will shortly have its form and place determined for it with geometrical precision.

There must therefore be something better and greater than a mould to make the or-

ganizable matter shape itself into a sheet of gauze and describe the inextricable labyrinth of the nervation. There is a primary plan, an ideal pattern which assigns to each atom its precise place. Before the matter begins to move, the configuration is already virtually traced, the courses of the plastic currents are already marked out. The stones of our buildings are arranged in accordance with the architect's considered plan; they form an ideal assemblage before existing as a real assemblage. Similarly, a Locust's wing, that sumptuous piece of lace emerging from a miserable sheath, speaks to us of another Architect, the Author of the plans which life must follow in its labours.

The genesis of living creatures offers to our contemplation, in an infinity of ways, marvels far greater than those of the Acridian; but generally they pass unperceived, overshadowed as they are by the veil of time. The lapse of years, with its slow mysteries, robs us of the most astonishing spectacles, unless our minds be endowed with a stubborn patience. Here, by exception, things take place with a swiftness that arrests even a wavering attention.

He who would, without wearisome delays,

catch a glimpse of the inconceivable dexterity with which life does its work has but to go to the great Locust of the vines. The insect will show him that which, with their extreme slowness, the sprouting seed, the budding leaf and the blossoming flower hide from our curiosity. We cannot see a blade of grass grow; but we can easily witness the growth of a Locust's wings and wing-cases.

We stand astounded at this sublime phantasmagoria of a grain of hemp-seed which in a few hours becomes a superb piece of linen. What a proud artist is life, driving its shuttle to weave the wings of a Locust, one of those insignificant insects of which Pliny, long ago said:

"In his tam parvis, fere nullis, quæ vis, quæ sapientia, quam inextricabilis perfectis!"

How well the old naturalist was inspired on this occasion! Let us repeat after him:

"What power, what wisdom, what indescribable perfection in the tiny corner of life which the Locust of the vines has shown us!"

I have heard that a learned enquirer, to whom life was but a conflict of physical and

chemical forces, did not despair of one day obtaining artificial organizable matter: protoplasm, as the official jargon has it. Were it in my power, I should hasten to satisfy this ambitious person.

Very well, be it so: you have thoroughly prepared your protoplasm. By dint of long hours of meditation, deep study, scrupulous care and inexhaustible patience, your wishes have been fulfilled; you have extracted from your apparatus an albuminous glair, which goes bad easily and stinks like the very devil in a few days' time: in short, filth. What do you propose to do with your product?

Will you organize it? Will you give it the structure of a living edifice? Will you take a hypodermic syringe and inject it between two impalpable films to obtain were it only the wing of a Gnat?

For that is more or less what the Locust does. He injects his protoplasm between the two scales of the pinion; and the material becomes a wing-case, because it finds as a guide the ideal archetype of which I spoke just now. It is controlled in its intricate windings by a plan which existed before the injection, before the material itself.

Have you this archetype, this coordinator of forms, this primordial regulator, at the end of your syringe? No? Then throw away your product! No life will ever spring from that chemical ordure.

CHAPTER XX

THE FOAMY CICADELLA

IN April, when the Swallow and the Cuckoo visit us, let us consider the fields for a while, keeping our eyes on the ground, as befits the eager observer of insect-life. We shall not fail to see, here and there, on the grass, little masses of white foam. It might easily be taken for a spray of frothy spittle from the lips of a passer-by; but there is so much of it that we soon abandon this first idea. Never would human saliva suffice for so lavish an expenditure of foam, even if some one with nothing better to do were to devote all his disgusting and misdirected zeal to the effort.

While recognizing that man is blameless in the matter, the northern peasant has not relinquished the name suggested by the appearance: he calls those strange flakes "Cuckoo-spit," after the bird whose note is then proclaiming the awakening of spring.

The vagrant creature, unequal to the toils and delights of housekeeping, ejects it at random, so they say, as it pays its flying visits to the homes of others, in search of a resting-place for its egg.

The interpretation does credit to the Cuckoo's salivary powers, but not to the interpreter's intelligence. The other popular denomination is worse still: "Frog-spit!" My dear good people, what on earth has the Frog or his slaver to do with it?[1]

The shrewder Provençal peasant also knows that vernal foam; but he is too cautious to give it any wild names. My rustic neighbours, when I ask them about Cuckoo-spit and Frog-spit, begin to smile and see nothing in those words but a poor joke. To my questions on the nature of the thing they reply:

"I don't know."

Exactly! That's the sort of answer I like, an answer not complicated with grotesque explanations.

Would you know the real perpetrator of this spittle? Rummage about the frothy

[1] Kirby and other English naturalists refer to *Aphrophora spumaria* as the Frothy Froghopper; but this is rather because the insect's outline and hopping-powers suggest those of a Frog.—*Translator's Note.*

mass with a straw. You will extract a little yellow, pot-bellied, dumpy creature, shaped like a Cicada without wings. That's the foam-producer.

When laid naked on another leaf, she brandishes the pointed tip of her little round paunch. This at once betrays the curious machine which we shall see at work presently. When older and still operating under the cover of its foam, the little thing becomes a nymph, turns green in colour and gives itself stumps of wings fixed scarfwise on its sides. From underneath its blunted head there projects, when it is working, a little gimlet, a beak similar to that of the Cicadæ.

In its adult form the insect is, in fact, a sort of very small-sized Cicada, for which reason the entomologist capable of shaking off the trammels of nonsensical nomenclature calls it simply the Foamy Cicadella. For this euphonic name, the diminutive of Cicada, the others have substituted that horrible word Aphrophora. Orthodox science says, *Aphrophora spumaria,* meaning Foamy Foambearer. The ear is none the better for this improvement. Let us content ourselves with Cicadella, which respects the tympanum and does not reduplicate the foam.

The Foamy Cicadella

I have consulted my few books as to the habits of the Cicadella. They tell me that she punctures plants and makes the sap exude in foamy flakes. Under this cover, the insect lives sheltered from the heat. A work recently compiled has one curious piece of information: it tells me that I must get up early in the morning, inspect my crops, pick any twig with foam on it and at once plunge it into a cauldron of boiling water.

Oh, my poor Cicadella, this is a bad look-out! The author does not do things by halves. I see him rising before the dawn, lighting a stove on wheels and pushing his infernal contrivance through the midst of his lucern, his clover and his peas, to boil you on the spot. He will have his work cut out for him. I remember a certain patch of sainfoin of which almost every stalk had its foam-flakes. Had the stewing-process been necessary, one might just as well have reaped the field and turned the whole crop into herb-tea.

Why these violent measures? Are you so very dangerous to the harvest, my pretty little Cicada? They accuse you of draining the plant which you attack. Upon my word, they are right: you drain it almost as dry as

the Flea does the Dog. But to touch another's grass—you know it: doesn't the fable say so?—is a heinous crime, an offence which can be punished by nothing less drastic than boiling water.

Let us waste no more time on these agricultural entomologists with their murderous designs. To hear them talk, one would think that the insect has no right to live. Incapable of behaving like a ferocious landowner who becomes filled with thoughts of massacre at the sight of a maggoty plum, I, more kindly, abandon my few rows of peas and beans to the Cicadella: she will leave me my share, I am convinced.

Besides, the insignificant ones of the earth are not the least rich in talent, in an originality of invention which will teach us much concerning the infinite variety of instinct. The Cicadella, in particular, possesses her recipes for aerated waters. Let us ask her by what process she succeeds in giving such a fine head of froth to her product, for the books that talk about boiling cauldrons and Cuckoo-spit are silent on this subject, the only one worthy of narration.

The foamy mass has no very definite shape and is hardly larger than a hazel-nut. It is

remarkably persistent even when the insect is not working at it any longer. Deprived of its manufacturer, who would not fail to keep it going, and placed on a watch-glass, it lasts for more than twenty-four hours without evaporating or losing its bubbles. This persistency is striking, compared with the rapidity with which soapsuds, for instance, disappear.

Prolonged duration of the foam is necessary to the Cicadella, who would exhaust herself in the constant renewal of her products if her work were ordinary froth. Once the effervescent covering is obtained, it is essential that the insect should rest for a time, with no other task than to drink its fill and grow. And so the moisture converted into froth possesses a certain stickiness, conducive to longevity. It is slightly oily and trickles under one's finger like a weak solution of gum.

The bubbles are small and even, being all of the same dimensions. You can see that they have been scrupulously gauged, one by one; you suspect the presence of a graduated tube. Like our chemists and druggists, the insect must have its drop-measures.

A single Cicadella is usually crouching in-

visible in the depths of the foam; sometimes there are two or three or more. In such cases, it is a fortuitous association, the fabrics of the several workers being so close together that they merge into one common edifice.

Let us see the work begin and, with the aid of a magnifying-glass, follow the creature's proceedings. With her sucker inserted up to the hilt and her six short legs firmly fixed, the Cicadella remains motionless, flat on her stomach on the long-suffering leaf. You expect to see froth issuing from the edge of the well, effervescing under the action of the insect's implement, whose lancets, ascending and descending in turns and rubbing against each other like those of the Cicada, ought to make the sap foam as it is forced out. The froth, so it would seem, must come ready-made from the puncture. That is what the current descriptions of the Cicadella tell us; that was how I myself pictured it on the authority of the writers. All this is a huge mistake: the real thing is much more ingenious. It is a very clear liquid that comes up from the well, with no more trace of foam than in a dewdrop. Even so the Cicada, who possesses

similar tools, makes the spot at which she slakes her thirst give forth a limpid fluid, with not a vestige of froth to it. Therefore, notwithstanding its dexterity in sucking up liquids, the Cicadella's mouth-apparatus has nothing to do with the manufacture of the foamy mattress. It supplies the raw material; another implement works it up. What implement? Have patience and we shall see.

The clear liquid rises imperceptibly and glides under the insect, which at last is half inundated. The work begins again without delay. To make white of egg into a froth we have two methods: we can whip it, thus dividing the sticky fluid into thin flakes and causing it to take in air in a network of cells; or we can blow into it and so inject air-bubbles right into the mass. Of these two methods, the Cicadella employs the second, which is less violent and more elegant. She blows her froth.

But how is the blowing done? The insect seems incapable of it, being devoid of any air-mechanism similar to that of the lungs. To breathe with tracheæ and to blow like a bellows are incompatible actions.

Agreed; but be sure that, if the insect

needs a blast of air for its manufactures, the blowing-machine will be there, most ingeniously contrived. This machine the Cicadella possesses at the tip of her abdomen, at the end of the intestine. Here, split lengthwise in the shape of a Y, a little pocket opens and shuts in turns, a pocket whose two lips close hermetically when joined.

Having said this, let us watch the performance. The insect lifts the tip of its abdomen out of the bath in which it is swimming. The pocket opens, sucks in the air of the atmosphere till it is full, then closes and dives down, the richer by its prize. Inside the liquid, the apparatus contracts. The captive air escapes as from a nozzle and produces a first bubble of froth. Forthwith the air-pocket returns to the upper air, opens, takes in a fresh load and goes down again closed, to immerse itself once more and blow in its gas. A new bubble is produced.

And so it goes on with chronometrical regularity, from second to second, the blowing-machine swinging upwards to open its valve and fill itself with air, downwards to dive into the liquid and send out its gaseous contents. Such is the air-measurer, the drop-

glass which accounts for the evenness of the frothy bubbles.

Ulysses, the favourite of the gods, received from the storm-dispenser, Æolus, bags in which the winds were confined. The carelessness of his crew, who untied the bags to find out what they contained, let loose a tempest which destroyed the fleet. I have seen those mythological wind-filled bags; I saw them years ago, when I was a child.

A peripatetic tinker, a son of Calabria, had set up between two stones the crucible in which a tin soup-tureen and plates were to be remelted. Æolus did the blowing, Æolus in the person of a little dark-skinned boy who, squatting on his heels, forced air towards the forge by alternately squeezing two goatskin bags, one on the right and one on the left. Thus must the prehistoric bronze-smelters have performed their task, they whose workshops and whose remains of copper-slag I find on the hills near my home: the blast of their furnaces was produced by these inflated skins.

The machine employed by my Æolus is pathetically simple. The hide of a goat, with the hair left on, is practically all that is necessary. It is a bag fastened at the

bottom over a nozzle, open at the top and supplied, by way of lips, with two little boards which, when brought together, close up the whole apparatus. These two stiff lips are each furnished with a leather handle, one for the thumb, the other for the four remaining fingers. The hand opens; the lips of the bag part and it fills with air. The hand closes and brings the boards together; the air imprisoned in the compressed bag escapes by the nozzle. The alternate working of the two bags gives a continuous blast.

Apart from continuity, which is not a favourable condition when the gas has to be discharged in small bubbles, the Cicadella's bellows works like the Calabrian tinker's. It is a flexible pocket with stiff lips, which alternately part and unite, opening to let the air enter and closing to keep it imprisoned. The contraction of the sides takes the place of the shrinking of the bag and puffs out the gaseous contents when the pocket is immersed.

He certainly had a lucky inspiration who first thought of confining the wind in a bag, as mythology tells us that Æolus did. The goatskin turned into a bellows gave us our metals, the essential matter whereof our

tools are made. Well, in this art of expelling air, an enormous source of progress, the Cicadella was the pioneer. She was blowing her froth before Tubalcain thought of urging the fire of his forge with a leather pouch. She was the first to invent bellows.

When, bubble by bubble, the foamy wrapper covers the insect to a height which the uplifted tip of her belly is unable to reach, it is no longer possible to take in air and the effervescence stops. Nevertheless, the gimlet that extracts the sap goes on working, for nourishment must be obtained. As a rule then, in the sloping part, the superfluous liquid, that which is not converted into foam, collects and forms a drop of perfectly clear liquid.

What does this limpid fluid lack in order to turn white and effervesce? Nothing but air blown into it, one would think. I am able to substitute my own devices for the Cicadella's syringe. I place between my lips a very slender glass tube and with delicate puffs send my breath into the drop of moisture. To my great surprise, it does not froth up. The result is just the same as that which I should have with plain water from the tap.

Instead of a plentiful, lasting, slow-subsiding foam, like that with which the insect covers itself, all that I obtain is a miserable ring of bubbles, which burst as soon as they appear. And I am equally unsuccessful with the liquid which the Cicadella collects under her abdomen at the start, before working her bellows. What is wrong in each case? The foamy product and its generating liquid shall tell us.

The first is oily to the touch, gummy and as fluid as, for instance, a weak solution of albumen would be; the second flows as readily as plain water. The Cicadella therefore does not draw from her well a liquid liable to effervesce merely by the action of the blow-pocket; she adds something to what oozes from the puncture, adds a viscous element which gives cohesion and makes frothing possible, even as a boy adds soap to the water which he blows into iridescent bubbles through a straw.

Where then does the insect keep its soap-works, its manufactory of the effervescent element? Evidently in the blow-pocket itself. It is here that the intestine ends and here that albuminous products, furnished either by the digestive canal or by special glands,

can be expelled in infinitesimal doses. Each whiff sent out is thus accompanied by a trifle of adhesive matter, which dissolves in the water, making it sticky and enabling it to retain the captive air in permanent bubbles. The Cicadella covers herself with an icing of which her intestine is to some extent the manufacturer.

This method brings us back to the industry of the lily-dweller, the grub which makes itself a loathsome armour out of its excretions;[1] but what a distance between the heap of ordure which it wears on its back and the Cicadella's aerated mattress!

Another fact, more difficult to explain, attracts our attention. A multitude of low-growing, herbaceous plants, whose sap starts flowing in April, suit the frothy insect, without distinction of species, genus or family. I could almost make a list of the non-ligneous vegetation of my neighbourhood by cataloguing the plants on which the little creature's foam is to be found in greater or lesser abundance. A few experiments will tell us how indifferent the Cicadella is to both

[1] The larva of the Lily-beetle (*Crioceris merdigera*), the essay on which insect has not yet been translated into English.—*Translator's Note.*

the nature and the properties of the plant which she adopts as her home.

I pick the insect out of its froth with the tip of a hair-pencil and place it on some other plant, of an opposite flavour, letting the strong come after the mild, the spicy after the insipid, the bitter after the sweet. The new encampment is accepted without hesitation and soon covered with foam. For instance, a Cicadella taken from the bean, which has a neutral flavour, thrives excellently on the spurges, full of pungent milky sap, and particularly on *Euphorbia serrata,* the narrow notch-leaved spurge, which is one of her favourite dwelling-places. And she is equally satisfied when moved from the highly-spiced spurge to the comparatively flavourless bean.

This indifference is surprising when we reflect how scrupulously faithful other insects are to their plants. There are undoubtedly stomachs expressly made to drink corrosive and assimilate toxic matters. The caterpillar of *Acherontia atropos,* the Death's-head Hawk-moth, eats its fill of potato-leaves, which are seasoned with solanin; the caterpillar of the Spurge-moth browses in these parts on the upright red spurge (*Euphorbia*

characias), whose milk produces much the same effect as red-hot iron on the tongue; but neither one nor the other would pass from these narcotics or these caustics to utterly insipid fare.

How does the Cicadella manage to feed on anything and everything, for she evidently obtains nourishment while putting a head on her liquid? I see her thrive, either of her own accord or by my devices, on the common buttercup (*Ranunculus acris*), which has a flavour unequalled save by Cayenne pepper; on the Italian arum (*Arum italicum*), the veriest particle of whose leaves is enough to burn the lips; on the traveller's joy, or virgin's bower (*Clematis vitalba*), the famous beggars' herb, which reddens the skin and produces the sores in request among our sham cripples. After these highly-seasoned condiments, she will promptly accept the mild sainfoin, the scented savory, the bitter dandelion, the sweet field eringo, in short, anything that I put before her, whether full-flavoured or tasteless.

As a matter of fact, this strange catholicity of diet might well be only apparent. When the Cicadella punctures this or that herb, of whatever species, all that she does

is to extract an almost neutral liquid, just as the roots draw it from the soil; she does not admit to her fountain the fluids worked up into essential principles. The liquid that trickles forth under the insect's gimlet and forms a bead at the bottom of the foamy mass is perfectly clear.

I have gathered this drop on the spurge, the arum, the clematis and the buttercup. I expected to find a fire-water, pungent as the sap of those different plants. Well, it is nothing of the kind; it lacks all savour; it is water or little more. And this insipid stuff has issued from a reservoir of vitriol.

If I prick the spurge with a fine needle, that which rises from the puncture is a white, milky drop, tasting horribly bitter. When the Cicadella pushes in her drill, a clear, flavourless fluid oozes out. The two operations seem to be directed towards different sources.

How does she manage to draw a liquid that is clear and harmless from the same barrel whence my needle brings up something milky and burning? Can the Cicadella, with her instrument, that incomparable alembic, divide the fierce fluid into two, admitting the neutral and rejecting the pep-

pery? Can she be drawing on certain vessels whose sap, not yet elaborated, has not acquired its final virulence? The delicate vegetable anatomy is helpless in the presence of the tiny creature's pump. I give up the problem.

When the Cicadella is exploring the spurge, as frequently happens, she has a serious reason for not admitting to her fountain all that would be yielded by simple bleeding, such as my needle would produce. The milky juice of the plant would be fatal to her.

I gather a drop or two of the liquid that trickles from a cut stalk and instal a Cicadella in it. The insect is not comfortable: I can see this by its efforts to escape. My hair-pencil pushes the fugitive back into the pool of milk, rich in dissolved rubber. Soon this rubber settles into clots similar to crumbs of cheese; the insect's legs become clad in gaiters that seem made of casein; a coating of gum obstructs the breathing-valves; possibly also the extremely delicate skin is hurt by the blistering qualities of the milky sap. If kept for some time in that environment, the Cicadella dies.

Even so would she die if her gimlet, working simply as a needle, brought the milk of

the spurge to the surface. A sifting takes place then, which allows almost pure water to issue from the source that gives the wherewithal for making the froth. A subtle exhaustion-process, whose mechanism is hidden from our curiosity, a piston-play of unrivalled delicacy, effects this marvellous work of purification.

Water is always water, whether it come from the stagnant pool or the clear stream, from a poisonous liquid or a healing infusion; and it possesses the same properties, when it is rid of its impurities by distillation. In like manner, the sap, whether furnished by the spurge or the bean, the clematis or the sainfoin, the buttercup or the borage, is of the same watery nature when the Cicadella's syphon, by a reducing-process which would be the envy of our stills, has deprived it of its peculiar properties, which vary so greatly in different plants.

This would explain how the insect makes its froth rise on the first plant that it comes across. Everything suits it, because its apparatus reduces any sap to the condition of plain water. The inimitable well-sinker is able to produce the limpid from the cloudy and the harmless from the toxic.

It may possibly happen that the insect's well supplies water that is not quite pure. If left to evaporate in a watch-glass, the clear drop that trickles from the mass of foam yields a thin white residue, which dissolves by effervescence in nitric acid. This residue might well be carbonate of potash. I also suspect the presence of traces of albumen.

Obviously, the Cicadella finds something to feed on at the bottom of the puncture. Now what does she consume? To all appearances, something with an albuminous basis, for the pigmy herself is, for the most part, but a grain of similar matter. This element is plentiful in all plants; and it is probable that the insect uses it lavishly to make up for the expenditure of gum needed for the formation of froth. Some albuminous product, perfected in the digestive canal and discharged by the intestine as and when the blow-pocket expels its bubble of air, might well give the liquid the power of swelling into a foam that lasts for a long time.

If we ask ourselves what advantage the Cicadella derives from her mass of froth, a very excellent answer is at once suggested:

the insect keeps itself cool under that shelter, hides itself from the eyes of its persecutors and is protected against the rays of the sun and the attacks of parasites.

The Lily-beetle makes a similar use of the mantle of her own dirt; but she, most unhappily for herself, flings off her nasty cloak and descends naked from the plant to the ground, where she has to bury herself to slaver her cocoon. At this critical moment, the Flies lie in wait for her and entrust her with their eggs, the germs of parasites which will eat into her body.

The Cicadella is better-advised and altogether escapes the dangers attendant on a removal. Subject to certain summary changes which never interrupt her activity, she assumes the adult form in the very heart of her bastion, under the shelter of a viscous rampart capable of repelling any assailant. Here she enjoys perfect security when the difficult hour has come for tearing off her old skin and putting on another, brand-new and more decorative; here she finds profound peace for her excoriation and for the display of the attire of a riper age.

The insect does not leave its cool covering until it is grown up, when it appears in

the form of a pretty little, brown-striped Cicadella. It is then able to take enormous and sudden leaps, which carry it far from the aggressor; and it leads an easy life, untroubled by the foe.

Looked upon as a system of defence, the frothy stronghold is indeed a magnificent invention, much superior to the squalid work of the invader of the lily. And, strange to say, the system has no imitators among the genera most nearly allied to the froth-blower.

In her larval form, the Asparagus-beetle is victimized by the Fly because she does not follow the example of her cousin, the Lily-beetle, and clothe herself in her own droppings. Even so, on the grass, on the trees displaying their tender leaves, other Cicadellæ abound, no less exposed to danger from the Warbler seeking a succulent morsel for his little ones; and, as they draw out the sap through the punctures made by their suckers, not one of them thinks of making it effervesce. Yet they too possess the elevator-pump, which they all work in the same manner; only they do not know how to turn the end of their intestine into a bellows. Why not? Because instincts are not to be

acquired. They are primordial aptitudes, bestowed here and denied there; time cannot awaken them by a slow incubation, nor are they decreed by any similarity of organization.

INDEX

A

Acherontia atropos (*see* Death's-head Hawk-moth)
Adder, 122, 125, 206
Æsop, 6-7
Agrion, 273
Alpine Analota, 231-235, 238, 299, 373
Ameles decolor (*see* Grey Mantis)
Ammonite, 273
Ammophila holosericea, 202-204
Anacreon, 13
Analota alpina (*see* Alpine Analota)
Anianus, 5*n*
Anoxia pilosa, 290
Ant, 1-2, 4-5, 7, 9-24, 176-178, 181, 183, 187-190, 199, 263, 298, 307, 321-323
Anthidium, 203
Anthophora, 109
Anthrax, 100
Ant-lion, 307
Aphis, 178
Aphrophora spumaria (*see* Foamy Cicadella)
Aristotle, 50-51, 53-55, 366
Ash Cicada, 59, 66-75, 80, 94
Asparagus-beetle, 445
Ass, 138, 257

B

Badger, 308
Bat, 201-202
Bee, 92, 121, 136, 146, 180, 202, 247, 251, 256
Beetle (*see also* the varieties), 22, 146, 255-256, 360
Bellot, M., 232
Béranger, Pierre Jean de, 4*n*, 13
Black Cicada, 59, 73
Blue-winged Locust, 214-217, 381-383, 389, 397-400
Bolboceras gallicus, 255-256
Bombyx, 205
Bordeaux Cricket, 309-310, 345-346
Buffon, Georges Louis Leclerc de, 253
Bull, 69, 249
Bull, the author's Dog, 133-134
Buprestis, 31-33
Burying-beetle (*see* Necrophorus)
Butterfly (*see also* the varieties), 121, 125, 146, 183, 198-199, 256, 302-305

Index

C

Cabbage Butterfly (*see* White Cabbage Butterfly)
Cacan (*see* Ash Cicada)
Callot, Jacques, 194
Caloptenus italicus (*see* Italian Locust)
Camel, 362
Capon, 188
Capricorn, 31-33, 255-256
Cassida (*see* Tortoise-beetle)
Cat, 3, 140, 196, 282
Centipede, 223*n*
Century Co., vii
Cephalopod, 223, 273, 299
Cerambyx (*see* Capricorn)
Cetonia, 11, 183
Chaffinch, 147
Chalcis, 92, 178
Chalicodoma, 365
Chicken, 188
Chrysomela, 360
Cicada (*see also* the varieties), vii, 1-112, 171-172, 178, 242, 256, 258-259, 263, 268, 276-278, 287-291, 343-344, 366, 412, 416, 426-427
Cicada atra (*see* Black Cicada)
Cicada hematodes (*see* Red Cicada)
Cicada orni (*see* Ash Cicada)
Cicada plebeia (*see* Common Cicada)
Cicada pygmæa (*see* Pigmy Cicada)
Cicada tomentosa, 73
Cigale (*see* Cicada)
Cigalon, Cigaloun (*see Cicada tomentosa*)
Coaltit, 265
Cockchafer (*see also* Pine Cockchafer), 290
Cockroach, 287*n*
Cod, 186-187
Common Black Cricket, Common Cricket (*see* Field Cricket)
Common Cicada, 59-66, 70-72, 74-112
Common Owl, 282
Common Snail, 223
Conocephalus mandibularis, 214*n*, 266
Copris, 255-256
Crab, 130, 366
Crab Spider, 129-136
Crayfish, 410
Crested Lark, 325-326
Cricket (*see also* the varieties), vii, 256, 258-259, 266, 287*n*, 295
Cri-cri (*see* Cricket)
Crioceris merdigera (*see* Lily-beetle)
Cross Spider, 120
Crow, 3
Cuckoo, 424
Cuckoo-spit (*see* Foamy Cicadella)
Cul-blanc (*see* Wheatear)
Cuttlefish, 223*n*

D

Daumas, General Eugène, 361

Index

Death's-head Hawk-moth, 438-439
Decticus (*see also* the varieties), 121, 123-124, 266, 287, 296, 299, 314, 317-318, 327, 329, 336-337, 399
Decticus albifrons (*see* White-faced Decticus)
Devilkin (*see Empusa pauperata*)
Diadema, Epeira (*see* Cross Spider)
Dioscorides, 50, 56
Dog, 319
Donkey (*see* Ass)
Dorbeetle (*see* Geotrupes)
Double-spotted Cricket, 309-310
Dragon-fly, 121, 225, 273
Drone, 22
Drone-fly (*see* Eristalis)
Dryden, John, 249*n*, 341*n*, 351*n*
Dung-beetle, 316, 322

E

Earwig, 11, 183, 287*n*
Edwards, Osman, viii, 20
Elephant, 53, 273-274
Empusa pauperata, 162, 191-210
Epeira (*see also* the varieties), 121
Epeira diadema (*see* Cross Spider)
Epeira sericea (*see* Silky Epeira)
Ephippiger (*see also* Vine Ephippiger), 124, 229-230, 232, 327
Ephippiger vitium (*see* Vine Ephippiger)
Eristalis, 197
Eucera, 203
Euripides, 290*n*
Eyed Lizard, 363

F

Fabre, Mlle. Marie Pauline, the author's daughter, 356-357
Fabre, Paul, the author's son, 356
Fallow-chat (*see* Wheatear)
Fallow-finch (*see* Wheatear)
Field Cricket, 283-284, 300-347, 350
Field-mouse, 183
Flea, 102
Florian, Jean Pierre Claris de, 302, 306
Fly (*see also* House-fly), 3, 11, 22-23, 118, 121, 146, 179, 183, 199-200, 256, 263, 444-445
Foamy Cicadella, vii, 287*n*, 424-446
Fox, 3, 308
Franklin, Benjamin, 335
Frog, 257
Frog-hopper, Frog-spit (*see* Foamy Cicadella)
Frothy Frog-hopper (*see* Foamy Cicadella)

G

Garden Spider (*see* Cross Spider, Silky Epeira)

Index

Geotrupes, 27
Gérard, Jean Ignace Isidore (*see* Grandville)
Glow-worm, 283
Gnat, 92-94, 127, 183, 322, 422
Goat, 3, 249
Grandville, 4
Grasshopper (*see also* Green Grasshopper, Ephippiger, Vine Ephippiger), vii, 5*n*, 8, 80, 117, 119, 135, 140, 198-199, 214, 218*n*, 224, 229, 233, 238-241, 245, 256, 258, 266-271, 277, 282, 287*n*, 327-328, 337, 362-363, 365, 370, 379, 392, 397-399
Greenfinch, 183
Green Fly (*see* Aphis)
Green Grasshopper, 228-229, 238, 263-265, 275-299, 327, 344
Green Tree-frog, 80
Grey Decticus, 238, 265-266
Grey Flesh-fly, 245
Grey Lizard, 177-178, 181, 273, 321, 363
Grey Locust, 120-121, 124, 127, 139, 355, 372, 383-388, 392, 393*n*, 395, 401-423
Grey Mantis, 126-127, 146, 160-161, 165-166, 173-174, 207-208
Gryllus bimaculatus (*see* Double-spotted Cricket)
Gryllus burdigalensis (*see* Bordeaux Cricket)
Gryllus desertus (*see* Solitary Cricket)
Guinea-fowl, 357-358

H

Hare, 300-301
Harpalus, 360
Helix aspersa (*see* Common Snail)
Hen, 358, 383
Herod Antipas, 365
Hive-bee, 130-135
Horned Owl (*see* Scops-owl)
Hornet, 22, 183
House Cricket, 346
House-fly, 195-197, 199

I

Intermediary Decticus, 214*n*, 265-266
Italian Cricket, 283-284, 346-352
Italian Locust, 214*n*, 355-356, 370-372, 379-381, 390
Iulus, 360

J

Jacotot, Joseph, 49

K

Kirby, William, 425*n*

L

La Fontaine, Jean de, 3-5, 7, 263, 300-302, 306
Lark (*see also* Crested Lark), 189

Index

L'Estrange, Sir Roger, *5n*
Leucospis, 92, 100
Libellula (*see* Dragon-fly, *Meganeura Monyi*)
Lily-beetle, 437, 444
Little Cicada, Little Cigale (*see Cicada tomentosa*)
Lizard (*see* Eyed Lizard, Grey Lizard)
Locust (*see also* the varieties), vii, 53, 117, 119, 121, 123-124, 126-130, 135-136, 138, 141, 163, 177, 179-180, 187, 189, 195, 199, 206, 211, 214, 218*n*, 227, 233, 238, 245, 287*n*, 353-423
Locusta viridissima (*see* Green Grasshopper)

M

Machato banarudo (*see* Scops-owl)
McKenna, Stephen, viii, 305*n*
Mammoth, 248, 273, 368
Mantis (*see also* the varieties), vii, 287*n*
Mantis religiosa (*see* Praying Mantis)
Matthiolus, 50
Mattioli, Pietro Andrea (*see* Matthiolus)
Megalosaurus, 273
Meganeura Monyi, 273
Melolontha fullo (*see* Pine Cockchafer)
Miall, Bernard, vii, 255
Midge, 179, 181, 337
Millepede, 224
Moffett, Thomas, 169
Moth (*see also* the varieties), 146, 205
Moufet (*see* Moffett)
Mouse, 196
Muffet (*see* Moffett)
Myriapod, 223*n*

N

Nautilus, 273
Necrophorus, 322
Nightingale, 253-254

O

Octopus, 223*n*, 224
Odynerus, 203
Œcanthus pellucens (*see* Italian Cricket)
Œdipoda cærulescens (*see* Blue-winged Locust)
Œdipoda miniata, 214*n*
Oil-beetle, 100, 180
Olivier, Guillaume Antoine, 73
Omar, the second Caliph, 362, 364, 366
Opatrum, 360
Owl (*see* the varieties)
Ox, 368

P

Pachytylus cinerescens (*see* Grey Locust)
Pachytylus nigrofasciatus, 214*n*, 381-383, 388-389
Panther, 53
Partridge (*see also* Red-legged Partridge), 249, 364

Peacock, 53, 122
Pedestrian Locust, 373-377, 389-390
Pezotettix pedestris (*see* Pedestrian Locust)
Phaneroptera falcata, 266, 298-299
Pheasant, 188-189
Pieris brassica (*see* White Cabbage Butterfly)
Pigmy Cicada, 59, 73-74
Pine Cockchafer, 255-256, 290
Platycleis grisea (*see* Grey Decticus)
Platycleis intermedia (*see* Intermediary Decticus)
Pliny, 53, 421
Pompilus, 11
Praying Mantis, 113-130, 135-191, 193, 204-210, 221, 229, 234, 242, 291, 321, 387, 394
Prégo-Dièu (*see* Praying Mantis)
Pullet, 188

Q

Quail, 257

R

Rabbit, 3, 308
Rabelais, François, 51, 57
Ram, 195
Rassado (*see* Eyed Lizard)
Rat, 3
Réaumur, René Antoine Ferchault de, 25-26, 58, 73, 87, 92, 96, 102, 225
Red Cicada, 59, 71-72
Red-legged Partridge, 358-359
Reindeer, 251
Rhinoceros, 53
Ringed Calicurgus (*see* Pompilus)
Rodwell, Miss Frances, viii
Rondelet, Guillaume, 51
Rose-chafer (*see* Cetonia)
Rumford, Benjamin Thompson, Count, 160-162

S

Saxicola (*see* Wheatear)
Scolopendra, 223, 299
Scops-owl, 281-282, 284-285
Sheep, 274, 357, 368
Silky Epeira, 120
Sitaris, 109
Slug, 183
Snail (*see also* Common Snail), 249, 296, 360
Solitary Cricket, 309-310
Spanish Copris (*see* Copris)
Sparrow, 87-88, 183
Sparrow-hawk, 288
Sphex (*see also* Yellow-winged Sphex), 11
Sphingonotus cærulans 214*n*
Spider (*see also* the varieties), 145, 360
Spurge-moth, 438-439
Squid, 223*n*
Stone-chat (*see* Wheatear)
Swallow, 288, 355, 424

Swallow-tail, 303*n*
Swammerdam, Jan, 169

T

Teixeira de Mattos, Alexander, 11*n*, 92*n*, 100*n*, 109*n*, 120*n*, 136*n*, 245*n*, 255*n*
Theocritus, 249
Thomisus onustus, rotundatus (*see* Crab Spider)
Thompson, Benjamin (*see* Rumford)
Thrush, 257
Tiger, 53
Tiger-beetle, 307
Tiro-lengo (*see* Wryneck)
Toad, 278-285, 339
Topsell, Edward, 169*n*
Tortoise-beetle, 360
Tousserel, Alphonse, 360
Tree-frog (*see* Green Tree-frog)
Truxalis nasuta (*see* Tryxalis)
Tryxalis, 120-121, 124, 214*n*, 355, 372, 391-395
Turkey, 122, 357, 364, 369

V

Vine Ephippiger, 120, 214*n*, 238, 267-272, 294-299
Virgil, 249, 341, 351
Voltaire, François Marie Arouet de, 302*n*

W

Warbler, 183, 257, 445
Wasp, 11, 22, 183, 202, 322
Weevil, 360
Wheatear, 360-361
Whin-chat (*see* Wheatear)
White Cabbage Butterfly, 198-200
White-faced Decticus, viii, 120, 139, 211-274, 293-294
White-tail (*see* Wheatear)
Wild Boar, 257
Wolf, 3, 140, 186
Wood-louse, 183, 360
Wryneck, 188-189

X

Xiphidion, 266

Y

Yellow-winged Sphex, 323

QL
467
F22

APR 2 8 1971

RAYMOND H. FOGLER LIBRARY
DATE DUE

DEC 22 1978

QL467.F22 ORO
The life of the grasshopper
3 7550 00138757 1